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GUIDELINES TO CAREER DEVELOPMENT FOR WASTE WATER PLANT PERSONNEL

Environmental Protection Agency

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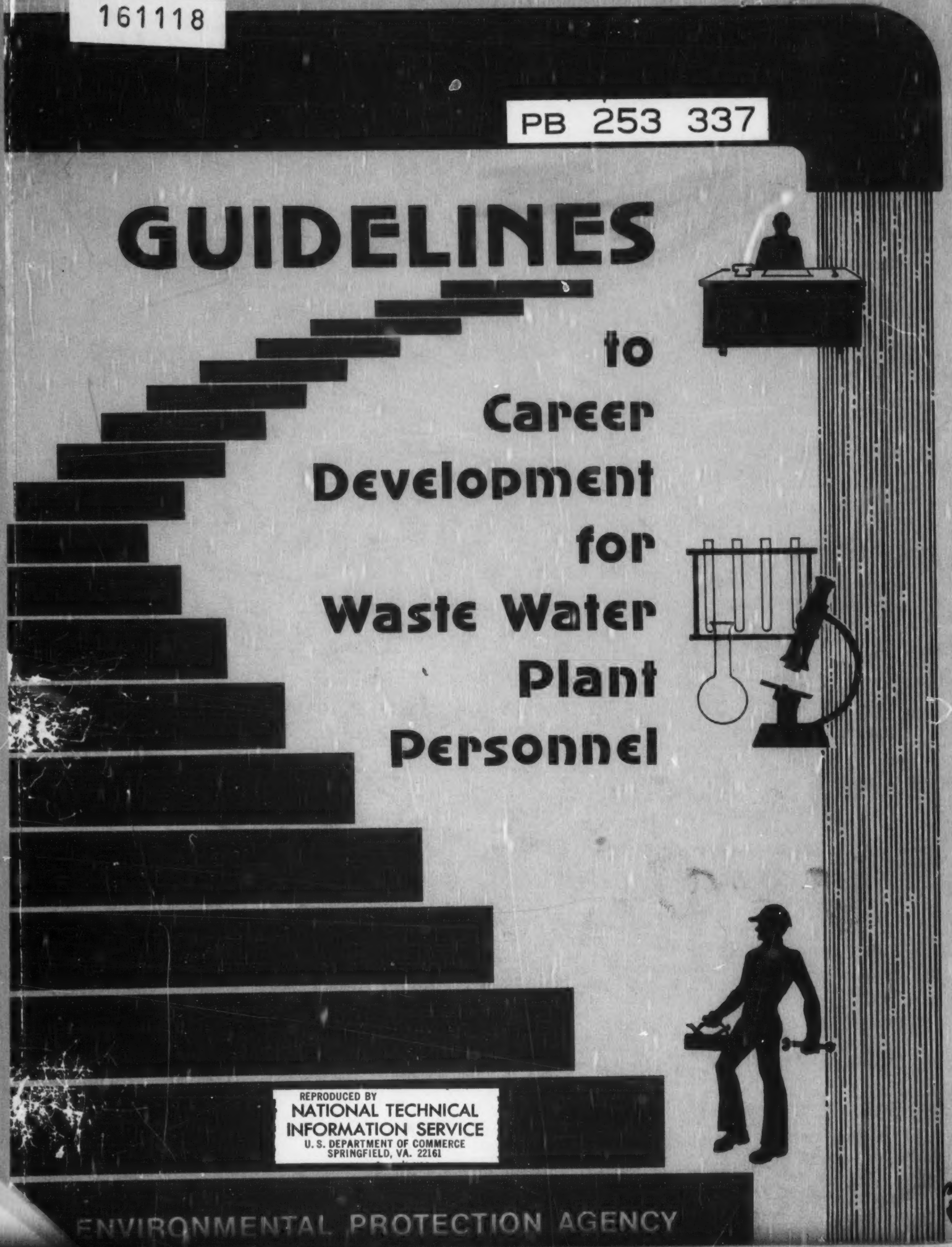
GUIDELINES to Career Development for Waste Water Plant Personnel



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GUIDELINES TO CAREER DEVELOPMENT FOR WASTEWATER TREATMENT PLANT PERSONNEL

* * * * *

for the

Public Service Careers Section
Office of Education and Manpower Planning
Environmental Protection Agency
Washington, D. C. 20460

September 1973

EPA REVIEW NOTICE

This document has been reviewed by the Environmental Protection Agency and approved for publication. Approval does not signify that the contents necessarily reflect the views and policies of the Environmental Protection Agency, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.

ACKNOWLEDGMENTS

The Environmental Protection Agency wishes to acknowledge and thank the Texas State Department of Health, the Arizona State Department of Health, the City of Phoenix, and the North Central Texas Council of Governments for their contributions and cooperation in making this publication possible.

The material in this document is representative of career development in only one of the many facets of environmental control. Recognition should be given to the units of government, professional associations, and other agencies that are supporting career development in the general field of environmental control and in wastewater treatment, in particular.

While the guidelines herein should be most helpful in the continuing development of careers in wastewater treatment, it is expected that with appropriate adaptations and interpretations they will be useful in the greater variety of occupations with which the Environmental Protection Agency is now concerned.

FOREWORD

Today, most people need assistance in making career choices. They need help in finding jobs that provide adequate incomes, opportunities for individual growth, and feelings of personal usefulness. In the frame of reference of these guidelines, it is expected that individuals will be challenged to move into the field of wastewater treatment and accept job training for advancement.

As the needs of our Nation for control of environment are met through treatment of wastewater, new jobs are created and others become obsolete. Keeping abreast of these changes is a responsibility of the work supervisor and hiring personnel. To be effective in career exploration with potential new hires, as well as current employees, they must have available relevant information about current and projected job descriptions. They must know the current employment and training practices in plants that vary in size and extent of technology.

We in the Office of Education and Manpower Planning hope that these uniform, job-structured guidelines will become a primary source of information for job counseling and the employment of wastewater employees. The career-development philosophy on which the guidelines are based holds much promise for meaningful employment and training experiences in terms of the individual needs of people.

George Pratt, Director
Office of Education and Manpower Planning
U. S. Environmental Protection Agency

PREFATORY NOTE

Presented herein is a highly useful aid in the development and training of wastewater plant employees. The guidelines are directly applicable to most functions and job responsibilities that exist in wastewater plants today, from the smallest to the largest, in all sections of the country. The successful use of the guidelines depends on the desire and willingness of the employee to be trained to proficiency, and relies on career-counseling to assist him in assessing his needs and establishing goals.

An individual's job responsibilities first must be defined with particular recognition being given to the type of wastewater facility, the size of work force involved, his level of responsibility, and his previous education and experience. This information assembled together will constitute a personal-technical profile of the individual and should be used to determine his technical strengths and weaknesses, and from these, priorities of training.

Once it has been determined what training is needed and desired, a series of goals can be established for the trainee. Once training has commenced, the trainee and the counselor should confer from time to time to evaluate the program and modify it to suit local requirements or demands on time.

A major impetus for this training program must come from the trainee's professional supervisor, and logically it follows that the professional supervisor is most particularly suited to fill the role of the counselor, since a direct relationship between these two individuals already exists. In the absence of such an individual, the guidance must be generated from other trained professionals such as the trainee's personnel director, his city engineer, his consulting engineer, or personnel from the state and local regulatory agencies. Regardless of the situation, however, the prime responsibility for training an employee belongs to the employer whose coordinative efforts are essential.

It seems reasonable to assume now that one of the functions of the Office of Education and Manpower Planning, Environmental Protection Agency, should be to provide assistance to state and local regulatory agencies in the development and implementation of necessary training programs.

Arthur Vondrick, Chairman
Advisory Committee for Development
of Training and Education Guidelines
for Wastewater Plant Occupations

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SECTION I

SUMMATION

The purpose of the guidelines to career development herein is to promote job growth and improvement in the personnel who manage, operate, and maintain wastewater treatment plants. The justification is to assure competent functioning of these facilities for the protection of public health and environment. Properly trained career-oriented professional wastewater plant operators and technicians are the key components in any water pollution control facility. In this field, as in any other, it has been proven that training pays dividends in increased production, savings in depreciation of the capital investment, better morale, and other ways.

The approach is to move from employment to training through specific modules of preparation which have been developed from recognized needs. These guidelines include 21 standard job classifications of positions normally found in the staffing of wastewater treatment plants, as defined by the Department of Labor, and related occupational summaries showing the specifications for each job. On each occupational summary sheet are the job description, basic qualifications, additional training needed, sources of that training, and entry and advancement information. It should be recognized that not all plants will have people in the 21 different jobs, and the work in two or more of the jobs may be done by one individual.

Along with the job classifications and characteristics, there is in Section V a complete set of "Training Modules". They cover 46 courses of instruction to be included in the training program. Each module has concise statement of purpose, identification of key content topics, together with ideas for making the training effective. These modular presentations may well be the basis for the development of a comprehensive training program manual for wastewater treatment plant workers.

Fundamentally, the various modules of training fit into "basic", "intermediate", "advanced", and "specialized" categories. This is in keeping with the classic method of providing wastewater plant operator training, based upon the complexity of the job assignment, whether the job be at a small, medium, or large treatment plant. The key factor in this guide to career development is that it is primarily related and identified to the individual rather than the treatment plant.

In Section V, there is identification of the training modules that are *directly* related to Operator Certification. It should be understood, however, that any or all of the training modules will produce a more comprehensively trained operator and, therefore, a greater capability for the individual to attain and retain certification proficiency.

SECTION II

INTRODUCTION

One fundamental question was basic to the preparation of this document: "How can job training and job counseling facilitate the career development processes for people already in, or about to enter, wastewater treatment plant occupations?" The question had to be considered in the current perspective of work and preparation for work.

In today's world of work, each individual must expect to experience a series of changes in employment as he moves through life. The nature, or dimensions, of employment are more dynamic than they have been in the past. Each individual can, therefore, expect to face more alternatives, to make many major and minor decisions. Today there is theory and evidence that suggests each job choice one makes should be the cumulative effect of a carefully thought-out career development process. It is argued that the identity one achieves in the world of work should not be a function of chance or the result of ability to squeeze through institutional gates. The identity one achieves should be a function of a variety of planned career development steps based on rational interpretation of available information and experience.

One's life style is frequently determined by what one does for a living. It was imperative, therefore, that we consider the assumptions, experiences, information, and procedures that have been, and are being, used to help an individual develop his identity in the occupational field of wastewater treatment. For those concerned about the employment of people in the area of wastewater treatment, this means infusing the career development concept into a training pattern and into counseling services.

In meeting the challenge in the fundamental question, it was determined that an individual-centered, training-oriented model was required as the base for wastewater treatment plant career development. It was recognized that such career development must be made a continuing process. The basic idea adopted was that career development should permeate all of the employment activities of wastewater workers of all ages.

Until recently, little recognition was given to the need for trained manpower—largely because the problem of pollution itself was relatively unrecognized. The passage of specific legislation to abate pollution and maintain the quality of the environment—together with the advancement of technology and the initiation of regulatory programs—caused the needs for trained manpower to increase.

Because water pollution control legislation has provided for training for a longer period, there is more knowledge of specific needs for manpower in this area than in air control or solid waste management. Yet, much diversity exists in training activities and career development today.

Additionally, several other factors affect the precise determination of manpower needs:

1. There is no generally accepted view concerning the numbers and types of personnel required to staff comparable wastewater facilities.
2. There are significant variations in the existing staffing patterns of comparable activities.
3. New technology is being introduced into the water quality field, but is not being carried over into wastewater operator training activities.
4. Requirements for the certification of operators vary widely among the fifty states.
5. The training available generally does not fit a pattern for career development in the industry.

Many knowledgeable people in the water quality field today feel that the "average" of existing operators will not be able to operate the sophisticated wastewater facilities of the future. Almost everyone agrees that the "average operator" cannot operate the facilities efficiently without further extensive training.

The effectiveness with which wastewater facilities are operated and maintained is dependent upon the quality of personnel employed in the facilities and the training provided subsequent to employment.

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SECTION III

INTENT AND APPROACH

The rapid increase in job openings in environmental control occupations that was predicted for the 1970's has become fact. Defilement of the water, soil, air and other parts of the environment is now recognized as a national problem. There are significant movements toward the attainment of national goals relative to control of pollution.

In terms of job openings the situation is clear. One example should suffice. In 1968, the Department of Labor indicated that there were 23,500 wastewater treatment plant operators in the United States. In 1970, the number had increased to 30,000; 4,000 in industrial wastewater treatment, 1,000 in Federal installations, and 25,000 in municipal plants.

The DOL predicts that the average annual openings for wastewater plant operators to 1980 will be 2,100. These openings will be the result of growth, deaths, and retirements, but do not include transfers out of the occupation. The rapid employment growth will result from the construction of new treatment plants and the modernization of existing plants.

Many factors have contributed to the development of the need for additional wastewater treatment facilities and personnel. In particular, there has been a nation-wide appreciation of the need to broaden the nature and scope of wastewater treatment and to refine the technology involved. But the lack of an adequate supply of trained wastewater treatment workers has frustrated the attainment of high priority national objectives in this field.

The wastewater treatment plant jobs with which this Guide is concerned center around plant operation, maintenance, laboratory, and administration. They range in pattern from the "menial" task kind of job to the job with much "decision making".

The Problem

Projected demands for increased numbers of wastewater treatment plant workers have resulted in a need to synthesize information related to the preparation and employment of skilled workers for wastewater treatment plant jobs with special emphasis directed toward both emerging and redefined jobs. Providing preparation in the job aspects that are important in the late 1970's is the challenge now before those persons responsible for the training programs.

The guidelines to career development for wastewater treatment plant personnel in this document were developed in an effort to implement and facilitate *employment* and *training* through:

1. Presentation of wastewater treatment plant jobs in terms of precise and accurate statements of the duties and tasks performed, along with certain indications of the levels of responsibility involved.
2. Identification for each job of the general qualifications required, essential training, and aspects of entry and advancement; this along with suggestions for additional training and sources of such training.
3. Determination of the general knowledges and abilities and the specific job knowledges and skills for which instruction is needed at present; along with the sequences in which subject matter should be studied for individuals to succeed in entry jobs and gain upward mobility in career patterns.
4. Development of training modules within the overall pattern of wastewater treatment plant staff training; with limited detail in terms of purpose of each module of training, design of instruction, brief outline of content, indication of time required, and processes that may be employed to enrich the teaching-learning efforts.

This entire document is directed toward presentation of material designed as follow-through of the above elements. Specifically, the material is organized to provide:

1. A presentation of information relative to wastewater plant occupations to provide supervisors with help in calling entry and advancement possibilities to the attention of individuals under their supervision.
2. A presentation of the entire pattern of training in the form of concise statements of some of the detail in modules that comprise a training program for wastewater treatment plant workers; that program to constitute adjunct study and instruction to be coupled with extensive amounts of on-the-job learning.
3. A summation of jobs and job training elements in the form of a curriculum grid that matches up jobs and modules of training that will promote success in entry jobs and advancement in careers by means of upgrade training.

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The Methodology

The accumulation, interpretation, and digesting of the extensive information essential to the project, and the preparation of this document, were organized and structured by a committee. The members of that committee are indicated on the next page. The Director of the overall project was Marvin Garza, North Central Texas Council of Governments.

Members of the committee conferred frequently by telephone and in person as the preparation of this document progressed. Much time was devoted to the review of wastewater treatment plant staffing and discussion of the development of job titles and occupational summaries. Similarly, much committee attention was given to the definition of training modules and to isolation of the subject-matter content that went into each module. Evaluation of this document in rough and in final form was done by members of the committee. Their editing over several weeks was most valuable.

The basic investigating and writing that went into this document was done by the professional staff and professional consultants associated with the North Central Texas Council of Governments (NCTCOG). Structured by the committee, this final report is the product of the efforts of numerous people, both members of the committee and others who were not members.

Extensive use was made of prior work done by similar groups and organizations. This is pointed up most succinctly in the reference list that makes up Section VII. While the reference list is relatively short, the items therein are of monumental value.

The work of the staff and consultants of NCTCOG took on major significance as they brought their experiences in training, counseling, and general manpower building to bear on this investigation. It should be understood that this project did not constitute "research". Instead, it was a professionally concerned, organized, and systematized investigative approach to the solution of a particular problem.

Meticulous searching-out of applicable information was the major task in the preparation of the guidelines herein. This was accompanied by the careful editing, one-to-one consideration of the details, and committee group discussion of desired outcomes. It was the solid effort of a competent staff correlated with the work of professional consultants that made solving of the problem possible.

ADVISORY COMMITTEE

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The Solution

The solution to the problem of this project is in three parts—Sections IV, V, and VI of this document. The guidelines material presented in those sections should be used to form the essential basis or foundation for developing a program for enhancing the roles of all wastewater plant personnel through career development. The establishment of such a program can be viewed in several steps or phases:

1. Development of Training Kits, which would include the preparation of training courses as outlines in the modules of training in Section V, along with appropriate films, slides, and other visual aids.
2. While such training material can be used "correspondence course" style, it is imperative that training courses be "taught" by qualified instructors.
3. It might be wise and prudent as time goes by for the Environmental Protection Agency or other appropriate agency to certify such instructors to insure conformity with the needs of training and the quality of course presentations.

While many courses and training aids are presently available and presently in use, these guidelines are perhaps the first attempt to assemble, identify, and correlate the training material with any degree of nationwide uniformity, which is essential.

A side benefit of this training and guidelines development effort will include preparation for jobs which can be assimilated into existing and even proposed state certification programs. Since certification generally requires some specialized training, certain of the training modules can be recommended. These are the modules most directly related to the operation and maintenance of plants.

SECTION IV

WASTEWATER TREATMENT PLANT OCCUPATIONS

To be useful in varied and widespread circumstances, information about wastewater treatment plant occupations must be standardized and uniformly understood. In this direction, the 1971 EPA survey (Reference 1)* provides information about 21 types of personnel commonly employed to operate and maintain conventional wastewater treatment plant facilities. The steps in gathering the data essential to the survey included:

1. Close observation of plant operations and discussions with supervisory personnel.
2. Study of available written job descriptions and comparison with actual tasks being performed.
3. Completion of a three-page occupational analysis form for each separate type of job.
4. Use of field information to identify 119 separate job titles and categories.
5. Analysis and comparison of actual duties to permit reduction of the 119 jobs to a list of 21 job descriptions.

In a solid effort to make widespread use of the information possible, the survey group obtained background data in field investigations of 23 wastewater treatment plants throughout the country.

Elements in Wastewater Treatment Plant Employment

The concern herein is with six elements in employment: (1) job classification, (2) job description, (3) basic qualifications, (4) additional training, (5) sources of training, and (6) entry and advancement. Each of these elements is discussed briefly in the material that follows.

Job Classification

Field information in the EPA survey identified 119 separate job titles and categories. Through analysis and comparison, these were reduced to 21. For use in these guideline materials, the job titles are further identified by 6-digit code numbers drawn from the *Dictionary of Occupational Titles* (Reference 2). Each of the "occupational summaries" in this section has job classification, by both title and DOT code number, as the first element.

Job Description

The EPA survey dealt with all major job duties commonly involved in the operation and maintenance of conventional wastewater treatment plants ranging in size from 1 to 100 million gallons per day. The 21 job descriptions developed in the *Dictionary* format and terminology were reviewed with analysts of the Occupational Analysis Field Center of the Department of Labor in St. Louis, Missouri, as well as by other agencies of the Federal Government.

In June of 1973, the 21 job descriptions were studied by the committee responsible for this document. It was the consensus that the job descriptions had been properly formulated and were standing the test of time, even in plants of less than one MGD in size. They were judged to be appropriate for use in the development of guidelines to career development for wastewater plant workers. The basic continuum of performance of wastewater treatment plant administration, laboratory, operations, and maintenance personnel is clearly defined in the 21 job descriptions. The committee did recognize that there may well be exceptions and additions to the basic list of 21 jobs in specific plants due to staffing "adjustment factors." Each of the 21 job descriptions is used herein as the second element of the occupational summary appropriate for that job classification.

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*The number in parentheses indicates an item in the References section of this document.

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Basic Qualifications

The underlying premise of occupational counseling, self-guidance, places primary responsibility for career development upon the individual himself. In any long-range career development, the individual with the help of counselors, teachers, fellow workers, employers, and others must assess his vocational potential and explore employment alternatives. He must look at his own qualifications and seek ways to acquire the abilities and capabilities required for the kind of work he seeks.

The basic qualifications presented here as the third element in each of the 21 occupational summaries were formulated from substantial kinds of information in such reliable references as: *Estimating Costs and Manpower Requirements for Conventional Wastewater Treatment Facilities* (1), *Occupational Outlook Handbook* (3), and *Selected Characteristics of Occupations* (4). In addition, consideration to what basic qualifications for the 21 jobs should be was given by the committee responsible for developing this document. That committee considered in depth each of the jobs and the requirements essential to success in that job.

Additional Training

The person hired for a job brings to the organization certain capabilities and capacities. In all probability, the new hire in a wastewater treatment plant will not bring to the organization all of the requisites needed to fulfill all job demands immediately. The job demands will exceed some of the capabilities and capacities of the new employee. The employee's deficiencies, then, must be reduced through a training program and supervised work experience.

For each of the 21 job classifications, there are recommendations or suggestions relative to additional training. For the most part, these are in terms of specific kinds of content to be studied. The terminology is that associated with the modules of training that constitute another major section of this document.

Sources of Training

Training needs, once identified, should lead to specific training plans and activities. Until recently in short supply, opportunities for training in the field of wastewater treatment are now being increased and extended at a rapid rate. Training now being done or contemplated includes formal and informal academic curriculums, institutional and non-institutional programs, and technical and non-technical subjects.

Four-year, college degree curriculums for engineers in plant construction, operation, and maintenance.
Two- and four-year college curriculums for chemists, biologists and laboratory technicians.
One- and two-year junior or community college curriculums for operations, maintenance, and laboratory people.
Vocational-technical school training in operations and maintenance; in both day and night classes for adults.
High school and vocational-technical school training in operations and maintenance; for juniors and seniors in pre-employment programs.
Basic adult education programs for general educational development (GED) or preparation foundational to job-related training.
"Short courses" offered by state and regional associations or by extension divisions of educational institutions.
Correspondence or special programmed-learning courses offered by colleges and universities on state or regional bases.
Federally sponsored programs provided through the Department of Labor, the Department of Health, Education, and Welfare, and the Environmental Protection Agency.
On-the-job training such as is offered through county or state health agencies or organizations such as councils of government.
Vestibule and in-service training by employers.

Regarding sources of training, a reliable reference indicates that:

> A well-rounded training program should contain the following elements: 1) Use of the facilities of the higher education system to the best advantage; 2) disperse the training so that small budget, short-staffed communities can take fullest advantage of the training; 3) offer courses which stratify the training so as not to go over-the-head of (or beneath) the trainee; and 4) have qualified vocational teachers. (Reference 5)

For each of the 21 job classifications presented in this section, possible sources of training are indicated. It is assumed that in a community, or within driving distance, one or more of the sources of training will be available. It is, of course, true that correspondence study is available to a person, wherever he may be. He simply needs to know where to obtain it. Training opportunities and the availability of training programs within any state can be ascertained by contacting the state water pollution control agency and/or the Office of Education and Manpower Planning of the Environmental Protection Agency.

Entry and Advancement

Entry into jobs in wastewater treatment plants ranges from men who are less than high school graduates who by chance inquire about a job to the employment of a college graduate as the result of an on-campus search for talent. Entry employment may follow a plan involving recruitment, testing, interviewing, and hiring. It may, on the other hand, be a most informal matter wherein one person says, "I want a job," and the other person says, "You're hired."

Advancement in jobs is essential to career development for wastewater treatment plant personnel. Upward mobility of workers is important in two ways: (1) the advancement of one worker usually results in an entry opportunity for another person, and (2) foremanship, supervision, and administrative capabilities stem from growth in jobs and advancement to higher-level jobs. The employment cycle (entry—training and experience—advancement) is usually immediately apparent in a plant where career development is promoted and effectively accomplished.

For each of the 21 job classifications, the entry and advancement possibilities are pointed up in brief fashion. The patterns of entry are varied. Study of the information presented indicates that, with the rapid development of this field of employment, there are no dead-end jobs.

Occupational Summaries

The occupational summaries presented in this section were developed around duties to be performed and responsibilities assigned. The summaries are not categorized in terms of treatment plants of varying sizes or complexity. It must be recognized that in many instances, particularly at smaller plants, certain individuals must fulfill multiple functions. With perhaps only five job classifications designated, the functions of administration, laboratory, operation, and maintenance must be fulfilled. A small plant might employ a total of eight people in five job classifications. This is exemplified in the example of a staffing guide displayed on the next page. Reference 1 includes eight additional staffing guides.

In much larger treatment plants, the job classifications may have to be increased from the base of 21, with such job titles as: Pump Station Operator II, Sludge-Filtration Operator, Grit Station Attendent, and so forth. As the functions of workers become more specialized within a plant, specialized job titles take on significance. Yet, in no instance is it likely that any new function will be developed in the foreseeable future.

To say that the 21 job classifications presented herein are "average" may be questioned. It is true, however, that the 21 classifications do deal with the "conventional" duties performed and responsibilities fulfilled in "conventional" wastewater treatment plants. To illustrate the pattern of thought involved in the foregoing statements, three illustrations are provided. See first the organization chart that utilizes the 21 job classifications to accomplish the four required functions. Then see the organization chart for a small plant. In the latter chart the four required functions appear to be lost. Yet, it is true that they must be covered by people who perform multiple functions. For example: the Operator II may pick up the laboratory function and the Operator I may pick up the administrative function of inventory control.

One-page occupational summaries for the 21 types of personnel commonly employed in conventional wastewater treatment plants are presented on the pages that follow.

Administration

1. Superintendent
2. Assistant Superintendent
3. Storekeeper
4. Clerk Typist

Laboratory

5. Chemist
6. Laboratory Technician

Plant Operation

7. Operations Supervisor
8. Shift Foreman
9. Operator II
10. Operator I
11. Laborer

Plant Maintenance

12. Maintenance Supervisor
13. Maintenance Mechanic Foreman
14. Maintenance Mechanic II
15. Maintenance Mechanic I
16. Maintenance Helper
17. Electrician II
18. Electrician I
19. Painter
20. Automotive Equipment Operator
21. Custodian

The summaries are presented in the functional order indicated above.

STAFF COMPLEMENTS FOR WASTEWATER TREATMENT PLANTS*

	Plant Average Day Capacity, mgd									
Occupation Title	1	3	5	10	20	35	50	65	80	100
	Estimated Number of Personnel									
Superintendent		.5	.5	1	1	1	1	1	1	1
Assistant Superintendent						1	1	1	1	1
Clerk Typist					1	1	2	2	3	4
Operations Supervisor							1	1	1	1
Shift Foreman						1	1	2	3	4
Operator II	1	2	3	4	5	5	8	10	10	12
Operator I	4	5	6	5	7	10	10	11	14	15
Auto. Equipment Operator						1	1	2	2	2
Maintenance Supervisor								1	1	1
Mech. Maintenance Foreman						1	1	1	2	3
Maintenance Mechanic II				1	1	2	2	2	2	3
Maintenance Mechanic I				.5	1	1	2	2	2	2
Electrician II					1	1	1	2	2	2
Electrician I						1	1	1	1	1
Maintenance Helper			1	1	2	3	4	4	5	6
Laborer	.5	1	1	2	3	4	5	6	7	8
Painter								.5	1	1
Storekeeper								1	1	1
Custodian							1	1	1	1
Chemist									.5	1
Laboratory Technician	1	1	1	1.5	2	2	3	3	3	3
Total Staff Complement	**6.5**	**9.5**	**12.5**	**16**	**24**	**35**	**45**	**54.5**	**63.5**	**73**

Notes:

(a) Plant components included in this example are:

Liquid Treatment	**Sludge Treatment**
Raw wastewater pumping	Primary sludge pumping
Preliminary treatment	Sludge digestion
Primary sedimentation	Sludge drying beds **(b)** **(1, 3 and 5 mgd plants)**
Aeration	Sludge lagoons **(c)** **(10 mgd and larger plants)**
Final sedimentation	
Recirculation pumping	
Chlorination	

Other Plant Components

Yardwork
Laboratory
Adminstration and general

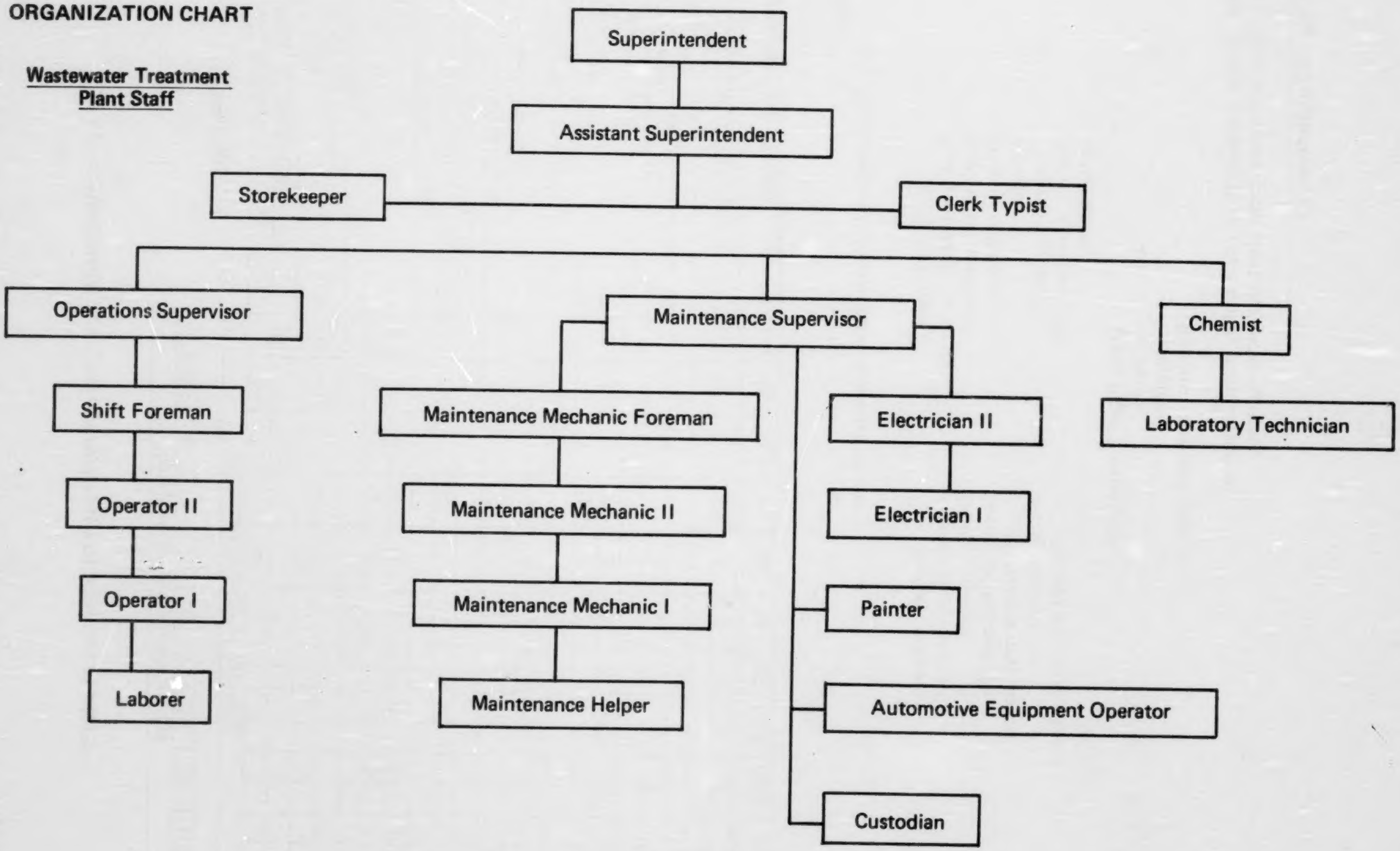
(b) Sludge removed from plant site by plant personnel.

(c) Sludge removed from plant site under contract.

***Page 142 of Reference 1.**

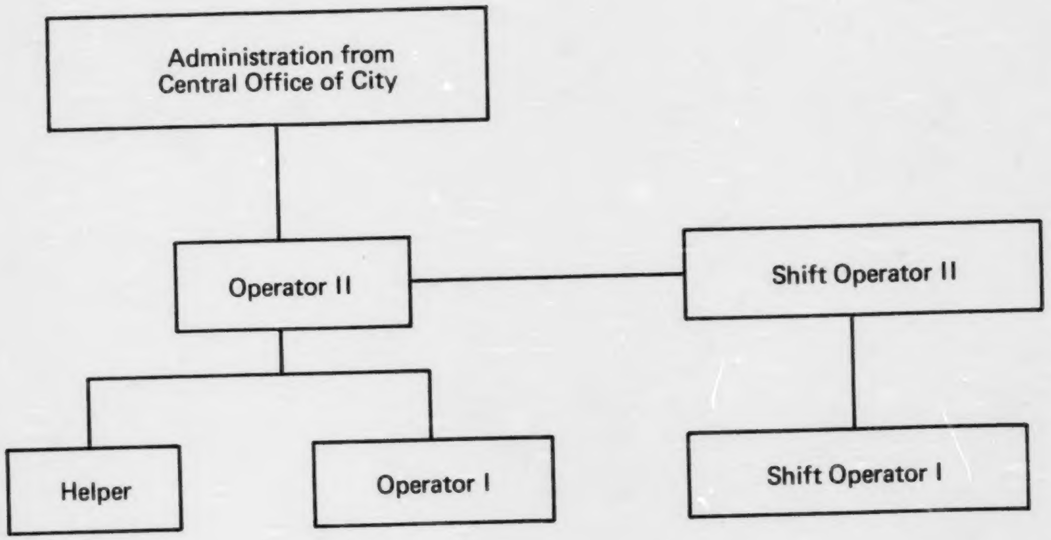
ORGANIZATION CHART

Wastewater Treatment Plant Staff


Superintendent
Assistant Superintendent
Storekeeper
Clerk Typist
Operations Supervisor
Maintenance Supervisor
Chemist
Shift Foreman
Maintenance Mechanic Foreman
Electrician II
Laboratory Technician
Operator II
Maintenance Mechanic II
Electrician I
Operator I
Maintenance Mechanic I
Painter
Laborer
Maintenance Helper
Automotive Equipment Operator
Custodian

ORGANIZATION CHART

Wastewater Treatment Plant Staff
(Small Plant)


Administration from Central Office of City
Operator II
Shift Operator II
Helper
Operator I
Shift Operator I

Occupational Summary 1

SUPERINTENDENT, WASTEWATER TREATMENT PLANT

DOT: 188.168

Job Description

Responsible for administration, operation, and maintenance of entire plant. Exercises direct authority over all plant functions and personnel, in accordance with approved policies and procedures. Inspects plant regularly. Analyzes and evaluates operation and maintenance functions; initiates or recommends new or improved practices. Develops plans and procedures to insure efficient plant operation. Recommends plant improvements and additions. Coordinates data and prepares or reviews and approves operation reports and budget requests. Controls expenditure of budgeted funds and requests approval for major expenditures, if required. Recommends specifications for major equipment and material purchases. Organizes and directs activities of plant personnel, including training programs. Maintains effective communications and working relationships with employees, government officials, and general public.

Basic Qualifications

Bachelor's degree in engineering or a related science field desirable; minimum high school. Substantial experience in applicable work at lower levels.

Demonstrated leadership qualities. Active role in professional organizations.

Expressed interest in assuming high level management responsibilities.

Additional Training

With a good background of preparation and work experience, the Superintendent still may reasonably expect to need new or refresher training, such as:

Wastewater Public Relations
Safety Program
Plant Regulation and Quality Standards
Wastewater Management Resources
Financial Reports
Supervision of Maintenance

Sources of Training

Regularly-offered, extension, correspondence, and short courses of colleges and universities: public or private.

Short courses and seminars offered by national and state regulatory agencies and by professional associations.

Day or night classes offered by vocational-technical schools.

Special short courses offered through manpower development programs of Federal organizations such as the Department of Labor, the Department of Health, Education, and Welfare, and the Environmental Protection Agency.

Entry and Advancement

Promotion from within is the most common way of filling this job; from Assistant Superintendent, Operations Supervisor, Maintenance Supervisor, or Chemist.

With successful performance and demonstrated ability, the Superintendent may move upward or laterally in either wastewater operations or administration. From a small plant, he may move to one that is larger. Advancement may mean administrative responsibility for more than one plant; a total water, wastewater, and sanitation system; or a position in a large city, county, or state public health department.

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Occupational Summary 2

ASSISTANT SUPERINTENDENT, WASTEWATER TREATMENT PLANT

Job Description **DOT: 188.168**

Assists in administrative and supervisory duties, under general direction of superintendent. Serves as superintendent in his absence. Aids in analyzing and evaluating operating and maintenance procedures, and in developing new or improved practices. Participates in maintenance of operating records, compilation of data, and report preparation. Assists in employee training. Inspects plant. Assists in planning special maintenance work and minor plant alterations.

Basic Qualifications

Bachelor's degree in engineering or a related science field desirable; minimum high school. Experience over several years in wastewater treatment plant operations and/or maintenance.

Membership in applicable groups. Subscriber to professional periodicals.

Expressed desire to assume management responsibilities and functions.

Additional Training

The Assistant Superintendent should continue, through scheduled courses and on-the-job training programs, to extend his capabilities relating to:

Wastewater Public Relations
Mathematics for Operators and Supervisors
Plant Evaluation and Work Economy
Records for Operations and Maintenance
Procurement of Materials and Equipment
Principles of Plant Management
Employment and Training of Staff
Safety Program

Sources of Training

Regularly-offered, extension, correspondence, and short courses of college and universities; both public and private.

Short courses and seminars offered by national and state regulatory agencies and by professional associations.

Day or night classes offered by vocational-technical schools.

Short courses and special on-the-job training arrangements through manpower development programs of Federal, regional, and state efforts of the Department of Labor, or other appropriate agency.

Entry and Advancement

Promotion from Operations Supervisor, Maintenance Supervisor, or Chemist. Recruitment from outside may be used to bring in new ideas, new techniques, new procedures, or a new personality.

With successful performance and demonstrated ability, the Assistant Superintendent should expect to become Superintendent, either at current work site or in another operating unit. The exceptional person may be promoted to even greater responsibility within the governmental unit.

Occupational Summary 3

STOREKEEPER, WASTEWATER TREATMENT PLANT

DOT: 223.387

Job Description

Requisitions, receives, stores, and issues materials, supplies, tools, and equipment. Maintains inventory records and controls. Duties include any combination of tasks such as following: Inspects incoming stock to verify quantity, quality, and adherence to specifications. Identifies and stores material. Fills orders and issues supplies from stock. Prepares periodic or perpetual inventory. Requisitions replacement quantities of stock items as necessary. Compiles records and reports of material used, spoilage or other loss, inventory adjustments, and refusal of shipments. Recommends changes in established procedures. Determines methods of storage, identification, and location of stock. Divides stock quantities into portions to fill orders.

Basic Qualifications

High school diploma or equivalent; successful completion of courses such as blueprint reading, mechanical drawing, shop mathematics, bookkeeping, typewriting, machine calculations, etc.

Demonstrated ability to work with written specifications or standards involving set limits and tolerances.

Numerical skill; clerical aptitude; ability to work with precision and accuracy in handling close detail.

Additional Training

Upon entering employment, the Storekeeper is likely to need refresher or new training in the following:

Communication Skills
Personal and Job Behavior
Basic and Related Mathematics
First Aid and Accident Prevention
Clerical Practices
Records Management
Recordkeeping and Inventory Control
Records for Operations and Maintenance
Procurement of Materials and Equipment

Sources of Training

Manpower development program for public service employees.
Night classes in vocational-technical school or local high school.
State, regional or federal on-the-job training program.
Accounting or data processing classes in junior or senior college.

Entry and Advancement

May acquire this job with help of public or private employment service. May be required to pass clerical, bookkeeping, or aptitude test. May have to demonstrate familiarity with specific materials, products, or standards.

With job-related training and work experience, the Storekeeper may be promoted by move to larger treatment plant or to central service unit. Progress may be in grade only.

Occupational Summary 4

CLERK TYPIST, WASTEWATER TREATMENT PLANT

Job Description

DOT: 209.388

Performs any combination of following tasks and/or other clerical duties: Operates typewriter and other standard office machines and equipment; including adding machine, calculator, and duplicating machine. Serves as secretary to superintendent. Acts as receptionist. Responsible for personal work determination in accordance with established precedent or policy. Sets up simple office routines and filing systems. Minor supervisory responsibilities. Composes routine correspondence. Answers telephone and handles routine inquiries from public. Typing includes tables, reports, requisitions, forms, and other material from copy, draft, or dictating machines; frequently involving judgment regarding format or information to be included. Clerical duties include maintaining financial records not requiring technical bookkeeping skills. Duties ordinarily include posting, filing, sorting, and other routine clerical functions.

Basic Qualifications

Successful completion of clerical subjects in high school.
Reading comprehension and ability to perform arithmetic computations.
Accuracy, attention to detail, and ability to follow directions.
Neat in personal appearance. Legible handwriting. Pleasant manner.
May be required to have high school diploma or equivalent.

Additional Training

During probationary employment period, the Clerk Typist should participate in training that relates to:

- Communication Skills
- Personal and Job Behavior
- Basic and Related Mathematics
- Clerical Practices
- Typewriting Applications
- Records Management

Sources of Training

Manpower development program for public service employees.
Night classes in vocational-technical school or local high school.
State, regional or federal on-the-job training program.
Night classes in junior or community college.

Entry and Advancement

May acquire this job with help of public or private employment service. May be required to pass clerical and/or typewriting tests.

With job-related training and work experience, the Clerk Typist may be given added duties and responsibilities; may move up to customer service, bookkeeping, stenographic, or other higher level jobs. Progress may be in grade only.

Occupational Summary 5

CHEMIST, WASTEWATER TREATMENT PLANT

DOT: 022.281

Job Description

Supervises and performs specialized and complex chemical, bacteriological and physical tests and analyses of raw, partially treated, and treated wastewater and byproducts to determine efficiency of plant processes and insure that plant effluent meets local, state, and federal requirements. Conducts or supervises less complex routine tests. Supervises collection of laboratory samples. When laboratory technicians are present, supervises technicians and provides routine procedures to be followed. Evaluates and interprets test results, establishes test priorities, and prepares reports. Assembles data, maintains records, and prepares periodic reports. Sets up pilot processes when conducting research on improved procedures. Provides direct or indirect instructions to operating personnel regarding chemical requirements and adjustments, changes, or additions to various treatment processes.

Basic Requirements

Collegiate study in science or environmental science; bachelor's degree preferred.

Additional Training

The Chemist will, from time to time, need to add to his knowledges and skills. This he is most likely to do through continuing education at a nearby college or university. He might well profit from study of the following:

Plant Evaluation and Work Economy
Laboratory Research

Sources of Training

Attendance at college or university.
Short courses and seminars offered by national and state regulatory agencies and by professional associations.
Independent study of professional journals and reports.

Entry and Advancement

Entry to this position is usually by placement from a college or univeristy.
Entry may occur as a result of study and experience in a laboratory situation.

Promotion results from professional experience, participation in professional organizations, publication, and desire to change jobs. Promotion may be to a job in a larger plant, to a wastewater research facility, or to an administrative position in a regional, state, or federal agency concerned about wastewater and other elements in environmental control. Promotion within the plant may be to Assistant Superintendent or Superintendent.

Occupational Summary 6

LABORATORY TECHNICIAN, WASTEWATER TREATMENT PLANT

Job Description

DOT: 022.281

Performs any combination of routine laboratory tasks such as following: Collects samples of plant influent, partially treated wastewater, sludge, effluent, and other byproducts. Assembles instruments and equipment for analytical or research work. Prepares chemical and bacteriological media, stains, reagents, and test solutions routinely used in laboratory. Operates equipment and conducts tests as directed. Maintains test result records, prepares data sheets. Prepares or assists in preparation of reports. Cleans, maintains, and stores instruments and equipment. Maintains inventory and orders supplies. Performs custodial duties in laboratory.

Basic Qualifications

Two or more years of college expected; may not preclude employment.

Academic success in science and laboratory courses in college or other scholastic environment. Experience assisting instructors in coursework or laboratory activities.

Expressed preference for laboratory and research kinds of work.

Additional Training

Continuation of collegiate level study; probably to attainment of bachelor's degree. The Laboratory Technician may couple on-the-job-training with some classroom instruction in courses such as:

Chemistry of Wastewater
Laboratory Procedures
Laboratory Research
Laboratory Records and Reports
Wastewater Plant Operation
Wastewater Treatment

Sources of Training

Attendance at nearby college or university.

Independent study of professional journals and reports relating to wastewater.

Short courses and seminars offered by national and state regulatory agencies and by professional associations.

Entry and Advancement

Entry to this position is usually based on completion of some study of chemistry including related laboratory work. The Laboratory Technician is then given the opportunity to become proficient through on-the-job training. Entry person may be required to have a bachelor's degree and/or be certified in wastewater treatment.

Continued study and work experience may result in promotion to Chemist.

Occupational Summary 7

OPERATIONS SUPERVISOR, WASTEWATER TREATMENT PLANT

Job Description

DOT: 184.168

Supervises and coordinates activities of plant operators, laborers, custodians, and other plant personnel. Prepares work schedules, subject to approval of superintendent or assistant superintendent. Analyzes recording instrument readings and laboratory test results; adjusts various plant processes accordingly. Prepares reports and maintains records. Inspects plant to determine efficiency of operation, cleanliness, and maintenance requirements. Determines remedial action in emergencies. Conducts training program. Requisitions chemicals and supplies. Performs duties of assistant superintendent in his absence.

Basic Qualifications

High school diploma or equivalent; completion of college engineering courses desirable.
Organizational ability. Facility with mathematics. Clear verbal expression.
Expressed desire to work in supervisory role.

Additional Training

Having a good foundation for his work, the Operations Supervisor should study more about:

- Wastewater Public Relations
- Mathematics for Operators and Supervisors
- Laboratory Procedures
- Safety Program
- Instrumentation
- Principles of Wastewater Management
- Supervision of Contracted Work
- Employment and Training of Staff

Sources of Training

Regularly-offered, extension, correspondence, and short courses of colleges and universities; both public and private.

Short courses and seminars offered by national and state regulatory agencies and by professional associations.

Special courses offered by vocational-technical school.

Short courses and special on-the-job training arrangements through manpower development programs of federal, regional, and state efforts of the Department of Labor, or other appropriate agency.

Entry and Advancement

Promotion from within is the most common method for filling this job; from Shift Foreman or Operator II.

With successful performance, continued preparation, and demonstrated ability, the Operations Supervisor may move up to Assistant Superintendent; then to Superintendent.

Occupational Summary 8

SHIFT FOREMAN, WASTEWATER TREATMENT PLANT

Job Description **DOT: 862.138**

Supervises operation of plant, under general direction of superiors. Performs duties of operations or maintenance supervisor in his absence. Supervises, instructs, and assigns specific duties to shift workers. Reviews and evaluates work performance. Participates in training programs. Inspects plant equipment and processes regularly. Analyzes instrument readings and laboratory tests results. Determines site and causes of any malfunctions. Orders, supervises, or participates in required adjustments or repairs. Maintains and evaluates operating records. Replaces operator or maintenance worker during emergency situations. Communicates with other shift foremen regarding plant conditions.

Basic Qualifications

High school graduate or equivalent. Should have some post-high school vocational training.

Demonstrated success in related nonsupervisory jobs. Interest in supervision.

Ability to understand and apply techniques. Ability to plan and assign duties to subordinates. Ability to maintain harmony in working relationships.

Additional Training

Assuming a good general background and work experience, the Shift Foreman probably should do in-depth study of:

- Personal and Job Behavior
- Electrical Systems
- Laboratory Procedures
- Safety Program
- Preventive and Corrective Maintenance
- Sludge Digestion
- Principles of Plant Management
- Supervision of Contracted Work

Sources of Training

Short courses and seminars offered by national and state regulatory agencies and by professional associations.

Special courses offered by vocational-technical school or private school providing emphasis on wastewater treatment.

Short courses and special on-the-job training arrangements through manpower development programs of federal, regional, or state agencies.

Entry and Advancement

Promotion from within is the most common method for filling this job. The move most likely would be Operator II to Shift Foreman.

With added study of public relations, supervision of maintenance, wastewater management, and other related elements, the Shift Foreman might reasonably expect to advance to Operations Supervisor, then to Assistant Superintendent, or Superintendent of a smaller plant.

Occupational Summary 9

OPERATOR II, WASTEWATER TREATMENT PLANT

Job Description

DOT: 955.782

Performs any combination of following tasks pertinent to controlling operation of plant: Operates treatment facilities to control flow and processing of wastewater, sludge, and effluent. Monitors gages, meters, and control panels. Observes variations in operating conditions and interprets meter and gage readings and test results to determine processing requirements. Operates valves and gates either manually or by remote control; starts and stops pumps, engines and generators to control and adjust flow and treatment processes. Maintains shift log and records meter and gage readings. Extracts samples and performs routine laboratory tests and analyses. Performs routine maintenance functions and custodial duties. Operates and maintains power generating equipment and incinerators. Makes operating decisions in absence of supervisory personnel.

Basic Qualifications

High school graduate or equivalent. Completion of some vocational training.
Good physical condition. Desire for recognition evident in initiative and drive.
Ability to work readily with others; to show them how to perform wastewater technical tasks. Holds proper certificate in wastewater treatment.
Skilled in the use of materials, tools, and machines.

Additional Training

The Operator II should expect to continue to grow in ability through study of such courses as:

Personal and Job Behavior
Mathematics for Operators and Supervisors
Laboratory Procedures
Procurement of Materials and Equipment
Safety in Operation and Maintenance
Preventive and Corrective Maintenance
Plant Regulation and Quality Standards

The training should be toward upgrading of certification.

Sources of Training

Short courses and seminars offered by national and state regulatory agencies and by professional associations.
Special courses offered by vocational-technical school, junior or community college, or private school with wastewater specialty.
Short courses and special on-the-job training offered by federal, regional, state, or city agencies.

Entry and Advancement

Promotion from within is the most common method for filling this job; usually from the Operator I level.

Advancement from the Operator II will involve moving to a larger or more modern plant; promotion to Shift Foreman or Operations Supervisor.

Occupational Summary 10

OPERATOR I, WASTERWATER TREATMENT PLANT

Job Description

DOT: 955.885

Assists Operator II in performance of any combination of following tasks pertinent to controlling operation of plant or performs various tasks as directed: Operates treatment facilities to control flow and processing of wastewater, sludge, and effluent. Monitors gages, meters, and control panels. Observes variations in operating conditions and interprets meter and gage readings and test results to determine processing requirements. Operates valves and gates either manually or by remote control; starts and stops pumps, engines, and generators to control and adjust flow and treatment processes. Maintains shift log and records meter and gage readings. Extracts samples and performs routine laboratory tests and analyses. Performs routine maintenance functions and custodial duties. Operates and maintains power generating equipment and incinerators.

Basic Qualifications

High school graduate or equivalent. Successful completion of shop training.

Good eyesight and overall good physical condition; manual and finger dexterity; ability to understand and follow written and oral instructions.

Reading habits, such as an interest in equipment and wastewater publications.

Additional Training

Directly out of high school, the individual probably should enroll in such courses as:

Communication Skills
Personal and Job Behavior
Mathematics for Operators and Supervisors
Chemistry of Wastewater
Care and Use of Tools
Care and Use of Tools
Preventive and Corrective Maintenance
Safety in Operation and Maintenance
Wastewater Plant Operation
Wastewater Treatment
Wastewater Collection Systems

The approach to training should be organized and pursued to end up with obtaining of the appropriate certificate.

Sources of Training

Short courses and special on-the-job training offered by federal, regional, state or city agencies.

Short courses and seminars offered by national and state regulatory agencies and by professional associations.

Entry and Advancement

Completion of pertinent training program or entry into on-the-job training is commonly the means by which a worker acquires this job. Experience as a machine tender may be required.

With supervised on-the-job training and technical instruction behind him, the Operator I may reasonably move into the Operator II job at his present site or at another plant.

Occupational Summary 11

LABORER, WASTEWATER TREATMENT PLANT

DOT: 955.887

Job Description

Performs any combination of tasks such as following: Cleans equipment such as bar screens, comminutors, and weirs. Lubricates machinery. Drives, loads and unloads trucks; spreads sand, gravel, and dirt. Paints (rough) and performs other minor mainteance. Digs and refills ditches. Cleans drains, ditches, and cluverts. Cuts grass, weeds, and brush; trims trees and bushes; rakes grass, leaves, and trash; seeds and cares for lawn and ornamental plantings. Removes snow and ice from walkways, driveways and equipment. Collects and disposes of trash. Washes and cleans vehicles, tools, and equipment. Carries or holds material, supplies, or tools to assist operating and/or maintenance personnel.

Basic Qualifications

Good physical condition; stamina; some dexterity with fingers and hands; an inclination toward routine; ability and willingness to follow instructions.

Undistinguished scholastic record. Demonstrated reliability, honesty and industry.

Additional Training

If not a high school graduate, the Laborer should attempt to complete the requirements for the GED certificate. He should develop competence as a wastewater plant employee through study of:

Communication Skills
Personal and Job Behavior
Basic and Related Mathematics
Basic and Related Science
First Aid and Accident Prevention
Safety in Operation and Maintenance
Care and Use of Tools
Buildings and Grounds Maintenance
Wastewater Plant Operation

Sources of Training

On-the-job training should be coupled with classroom study to ensure growth in general abilities and in specific related knowledges and skills. A public service careers training program would be good for the Laborer, either as entry training or as upgrade development.

The GED might be gotten either in the PSCTP or by means of local adult basic education training.

Entry and Advancement

Entry to the Laborer job classification usually has no previous training requirement. Entry may be from off-the-street, or by means of either a private or public employment service.

Having demonstrated desirable work traits and personal desire to improve, the Laborer may be helped to receive training in more complex work and thus gain added income and promotion. He may be promoted to Operator I.

Occupational Summary 12

MAINTENANCE SUPERVISOR, WASTEWATER TREATMENT PLANT

Job Description **DOT: 638.131**

Supervises all preventive and corrective maintenance on plant and equipment. Plans, schedules, and directs maintenance of wide variety of specialized mechanical and electrical equipment plus buildings, structures, and grounds. Inspects plant frequently to ensure proper maintenance procedures are followed. Determines the necessity for and establishes long-range maintenance programs. Decides remedial action in emergency situations. Supervises and instructs maintenance personnel. Supervises installation and testing of new or rebuilt equipment. Supervises inspection of contracted maintenance work. Submits maintenance budget requests. Supervises maintenance records. Performs related work as required.

Basic Qualifications

High school diploma or equivalent. Vocational Training in school or in adult education arrangement.

Ability to understand and apply maintenance techniques; ability to communicate this to persons supervised; ability to maintain harmony in working relationships and among workers.

Desire for recognition; reader of technical periodicals; participant in community and work organizations.

Successful work experience in lower level maintenance position(s).

Additional Training

The Maintenance Supervisor should continue his development through study of:

Communication Skills
Wastewater Public Relations
Safety Program
Supervision of Maintenance
Electrical Systems
Principles of Plant Management
Employment and Training of Staff

Sources of Training

Short courses and seminars offered by national and state regulatory agencies and by professional associations.

Short courses coupled with on-the-job training for public employees.

Private or public vocational-technical school; probably night classes.

Entry and Advancement

Individuals usually enter this supervisory job from the maintenance worker ranks; from within the particular employing unit. Promotion from Maintenance Mechanic Foreman or Maintenance Mechanic II.

This is a relatively high-level job in the wastewater family of jobs. Promotion usually means moving to a new or larger plant. Promotion to Assistant Superintendent or to Superintendent is possible within the plant.

Occupational Summary 13

MAINTENANCE MECHANIC FOREMAN, WASTEWATER TREATMENT PLANT

DOT: 638.131

Job Description

Supervises maintenance mechanic crew in performance of wide variety of maintenance and repair tasks on machinery, equipment, buildings, structures, and grounds. Duties include any combination of tasks such as following: Assigns tasks to maintenance crew. Directs and/or participates in maintenance and repair tasks as required. Supervises and instructs maintenance personnel on routine and emergency tasks. Consults superiors regarding preventive maintenance program. Establishes and operates preventive program. Inspects plant and mechanical equipment for malfunctions and needed repairs. Determines repair methods. Consults with superior and/or manufacturer's representative on difficult or complicated repairs. Keeps maintenance records. Works with contractors.

Basic Qualifications

High school diploma or equivalent. Vocational Training in school in adult education arrangement. Skilled in performance of mechanical maintenance.

Ability to demonstrate efficient technical "know-how" or work along with subordiantes in difficult phases of a job. Ability to maintain harmony among workers.

Additional Training

The Mechanical Maintenance Foreman should continue his career development through study of:

Communication Skills
Personal and Job Behavior
Safety in Operation and Maintenance
Safety Program
Supervision of Maintenance
Principles of Wastewater Management
Procurement of Materials and Equipment

Sources of Training

Short courses and seminars offered by national and state regulatory agencies and by professional associations.

Short courses coupled with on-the-job training for public employees.

Private or public vocational-technical school; probably night classes.

Entry and Advancement

Successful work experience as a Maintenance Mechanic II is the best means of entry to this job.

Continued study and valuable work experience lead to promotion to Maintenance Supervisor. They may lead to higher pay and better working conditions in another plant; either newer or larger.

Occupational Summary 14

MAINTENANCE MECHANIC II, WASTEWATER TREATMENT PLANT

Job Description

DOT: 638.281

Performs preventive maintenance and repairs on mechanical and electromechanical machinery and equipment, under general direction of superior. Maintains buildings, structures and grounds. Duties include any combination of tasks such as following: Lubricates equipment and checks for malfunctions. Replaces packing in pumps or valves. Replaces bearings in motors, pumps, and other equipment. Cleans out pipes and performs other plumbing and pipefitting tasks as required. Uses gas and/or arc welding equipment to heat, cut, braze, or weld. Performs duties of electrician and/or painter in their absence. Installs and sets up new equipment. Assists in keeping maintenance records. Supervises, instructs, and inspects work of Maintenance Mechanic I, Maintenance Helper, or Laborer to ensure proper performance of maintenance work or repairs. Performs general maintenance and repair tasks on buildings, structures, and grounds.

Basic Qualifications

Successful completion of high school industrial training or vocational education courses; or training received in armed service.

Ability to apply shop mathematics to practical problems; ability to read blueprints and diagrams; finger and manual dexterity along with eye-hand coordination; perference for work offering productive satisfaction.

Additional Training

The Maintenance Mechanic II may extend his abilities and skills by means of study of such courses as:

Communication Skills
Personal and Job Behavior
Mathematics for Operators and Supervisors
Safety in Operation and Maintenance
Painting and Other Protective Maintenance
Mechanical Maintenace

Sources of Training

Short courses coupled with on-the-job training for public employees.

Private or public vocational, trade, or technical school; probably night classes.

Entry and Advancement

Promotion from Maintenance Mechanic I is best means of entry to this job. Person may be hired from related kind of maintenance work and from outside.

The Maintenance Mechanic II, with experience, should move toward greater responsibility. With continued study and considerable experience, he may be promoted to Mechanical Maintenance Foreman or to Maintenance Supervisor.

Occupational Summary 15

MAINTENANCE MECHANIC I, WASTEWATER TREATMENT PLANT

DOT: 638.884

Job Description

Performs or assists in performance of preventive maintenance and repairs on mechanical and electromechanical machinery and equipment, under direction of Mechanic II, Foreman, or Supervisor. Maintains buildings, structures, and grounds. Duties include any combination of tasks such as following: Lubricates motors and equipment and checks for malfunction. Replaces packing in pumps and valves. Replaces bearings in motors, pumps, and other equipment. Installs and sets up new equipment. Cleans out pipes and performs other plumbing and pipefitting tasks as required. Uses gas and/or arc welding equipment to heat, cut, braze, or weld. Performs duties of electrician and/or painter in their absence. Assists Mechanic II and/or Foreman on difficult or highly complicated maintenance of repair tasks. Performs general maintenance and repair tasks on buildings, structures, and grounds, including limited laboring and custodial tasks. Assists in keeping maintenance records.

Basic Qualifications

Completion of high school industrial training; or equivalent.

Good eye-hand coordination; manual and finger dexterity; spatial and form perception; preference for working with the hands; facility in adapting to a routine.

Additional Training

The Maintenance Mechanic I should expect to learn much from on-the-job training. He should couple with that specific courses in content such as:

- Communication Skills
- Personal and Job Behavior
- Basic and Related Mathematics
- Basic and Related Science
- Electrical Maintenance
- First Aid and Accident Prevention
- Safety in Operation and Maintenance
- Preventive and Corrective Maintenance
- Gas and Arc Welding
- Painting and Other Protective Maintenance

Sources of Training

Vocational, trade, or technical school; public or private; day or night classes.

Entry training or on-the-job training for public employees.

Entry and Advancement

Entry to this job may be by means of Maintenance Helper, Laborer, or Custodian job classifications. A person may be hired off-the-street, or by means of help from private or public employment service unit.

Promotion from this job is upward in the maintenance pattern; to Maintenance Mechanic II, then to Foreman, on to Supervisor. Advancement in salary and responsibility may be outward to a new plant or to a larger plant.

Occupational Summary 16

MAINTENANCE HELPER, WASTEWATER TREATMENT PLANT

Job Description

DOT: 638.884

Assists maintenance mechanics in maintaining and repairing equipment, machinery, buildings, and grounds. Duties include any combination of tasks such as following: Cleans and lubricates pumps, motors, and related equipment. Assists in removing, repairing, and replacing equipment as directed. Performs routine building maintenance work. Performs simple repairs and adjustments to equipment. Keeps simple records. Carries or holds materials, supplies, or tools to assist mechanics, electricians, or painters. Performs laborer tasks as required.

Basic Qualifications

High school diploma expected but not essential to employment.
Good physical condition. Ability to follow written or oral instructions.
Expressed preference for working with hands.

Additional Training

The Maintenance Helper should complete all of the courses essential to his general preparation and the specific maintenance courses necessary for him to become fully competent.

Communication Skills
Personal and Job Behavior
Basic and Related Mathematics
Basic and Related Science
First Aid and Accident Prevention
Building and Grounds Maintenance
Safety in Operation and Maintenance
Preventive and Corrective Maintenance
Gas and Arc Welding
Eletrical Maintenance
Plumbing Maintenance
Painting and Other Protective Maintenance

Sources of Training

At first, on-the job training will be the chief means of occupational growth and development for the Maintenance Helper. The OJT should be coupled with classroom training.

Day or night classes in a vocation, trade, or technical school may also be good.

Entry and Advancement

Entry to this job may be gained simply through an off-the-street application. Access to the job may be with the help of public or private employment service agency.

Promotion from the Maintenance Helper position may be narrower applications of abilities such as Maintenance Mechanic I, then II; or specializations such as Painter, Electrician I, then II; etc.

Occupational Summary 17

ELECTRICIAN II, WASTEWATER TREATMENT PLANT

DOT: 829.281

Job Description

Inspects, repairs, and maintains electrical and/or electromechanical operating and control systems, equipment, and fixtures; including instrumentation and heating and cooling systems. Exercises independent judgment in solving normal work problems under general supervision of Maintenance Supervisor or Assistant Superintendent, using standard and special electrical tools and equipment, such as volt-meters, ammeters, and synchroscopes. Duties include any combination of tasks such as following: Inspects, maintains and repairs wiring and lighting systems, electrical control equipment, meters, outlets, and panels. Installs new equipment. Interprets oral and written instructions, specifications, wiring diagrams and codes. Supervises Electrician I, Maintenance Helper, and/or Laborer. Establishes and operates scheduled maintenance program for plant equipment. Repairs electrical and electronic instruments. Keeps maintenance records. Prepares labor and material estiamtes.

Basic Qualifications

High scholl diploma or equivalent. Considerable work experience in the trade.

Ability to use independent judgment in planning sequence of operations and in selecting proper tools and materials. Ability to read blueprints and diagrams. Appropriate understanding of the mathematics of electricity and machines.

Ability in basic electronics. May have to possess electrician's license.

Additional Training

The Electrician II must keep abreast of wastewater development and, in particular, of the developments in electronic equipment for plants. He should study in such areas as:

Communication Skills
Safety Program
Machinery Maintenance
Electrical Systems
Instrumentation
Procurement of Materials and Equipment

Sources of Training

Maintenance electricians learn and improve their skills primarily by accumulating experience in their work. Courses offered by vocation and trade schools, either public or private, are helpful.

Entry and Advancement

Promotion from the Electrician I job classification is the chief means of entry. Employment may at times be possible off-the-street or with the help of an employment service unit.

Skilled maintenance electricians may become foremen who supervise the work of other maintenance electricians or other maintenance personnel. Occassionally, they may advance to jobs such as Plant Electrical Superintendent or Plant Maintenance Superintendent.

Occupational Summary 18

ELECTRICIAN I, WASTEWATER TREATMENT PLANT

Job Description **DOT: 829.887**

Participates in installation, maintenance, and repair of electrical systems, equipment, and fixtrues. Assists Electrician II in particularly difficult or complicated tasks. Work is frequently performed independently, subject to inspection by superiors. Follows oral and written instructions including specifications, wiring diagrams, and codes. Duties include any combination of tasks such as following: Inspects, maintains, and repairs wiring and lighting systems, electrical control equipment, meters, outlets, and panels. Installs new equipment. Supervises Maintenance Helper and/or Laborer. Repairs electrical instruments. Keeps maintenance records.

Basic Qualifications

High school diploma expected but not essential to employment.

Some work experience in the trade; either in civilian employment or military service. Ability to learn and apply appropriate mathematics. Manual dexterity and eye-hand coordination.

Additional Training

The Electrician I should learn under the direction of the Electrician II. In addition, he should expect to study aspects of wastewater treatment plant operations in courses such as:

Communication Skills
Personal and Job Behavior
Basic and Related Mathematics
Basic and Related Science
First Aid and Accident Prevention
Safety in Operation and Maintenance
Preventive and Corrective Maintenance
Electrical Maintenance
Electrical Systems

Sources of Training

On-the-job training with the Electrician II closely supervising the work and instruction. Coupled with the OJT, the Electrician I should study such courses as are offered by private or public vocational-technical schools.

Entry and Advancement

The primary method of entry is an apprenticeship or other on-the-job training. Entry may be off-the-street or by means of help from a private or public employment service unit.

With experience and building of skills the Electrician I may be promoted to Electrician II.

Occupational Summary 19

PAINTER, WASTEWATER TREATMENT PLANT

Job Description **DOT: 840.781**

Performs all types of painting work, including any combination of tasks such as following, under general supervision of Maintenance Mechanic Foreman or Shift Foreman: Prepares various surfaces for painting by washing, scraping, burning, sanding, sand-blasting or other means as necessary. Mixes, matches, and blends various paints, enamels, lacquers, varnishes, stains, and special protective coatings to achieve desired color, consistency, and drying properties. Caulks, putties, cements, or plasters holes and cracks. Cuts and replaces glass in windows and doors. Erects and uses ladders, scaffolding, and swinging stage equipment as required. Paints buildings, structures, equipment, and furniture using brush, roller, spray gun or other applicator. Prepares wall and hangs paper or other wall covering material. Performs simple sign-painting, using stencils. Requisitions material and equipment. Cleans and stores tools and equipment. Cleans work site or arranges for laborer to clean.

Basic Qualifications

High school diploma expected but not essential to employment.
Knowledge of and ability as a Painter; gained through work experience or apprenticeship.
Good physical condition; manual dexterity; discerning color sense; not allergic to paint fumes.

Additional Training

To ensure competence as a Painter in wastewater plant operations, the person should study courses such as:

- Communication Skills
- Personal and Job Behavior
- First Aid and Accident Prevention
- Safety in Operation and Maintenance
- Preventive and Corrective Maintenance
- Painting and Other Protective Maintenance

Sources of Training

On-the-job training coupled with classroom instruction.
National Joint Painting and Decorating Apprenticeship program.

Entry and Advancement

Being hired in an on-the-job-training program is the most common way of entering this job classification. Apprenticeship program or work experience in a job of lesser complexity is a common method of entry.

The Painter may move from a small wastewater treatment plant to a larger plant where, as a member of the paint crew, he can be promoted to Foreman.

Occupational Summary 20

AUTOMOTIVE EQUIPMENT OPERATOR, WASTEWATER TREATMENT PLANT

Job Description

DOT: 905.883

Operates automotive equipment such as dump truck, tank truck, fork lift, or tractor. Performs maintenance on vehicles.

Basic Qualifications

Expected to have high school diploma (may not be deterrent to employment).

Considerable driving experience, such as in military driving of tank or truck or casual work experience in driving truck or farm tractor.

Spatial discrimination; eye-hand-foot coordination; manual dexterity; ability to follow written and oral instructions; generally good physical condition.

Additional Training

On-the-job training is the usual method by which the Automotive Equipment Operator acquires proficiency. He should expect to complete courses such as:

Communication Skills
Personal and Job Behavior
General Educational Development
First Aid and Accident Prevention
Care and Use of Tools
Automotive Equipment Maintenance

Sources of Training

Short courses coupled with on-the-job training.

Special truck driver training such as is offered by vocational-technical schools or privately operated, independent vocational school.

Entry and Advancement

Must have appropriate driver's license. May have to pass driver test administered by employing unit. May acquire this job with help of public or private employment service.

The Automotive Equipment Operator should expect to study extensively in the area of wastewater plant operation if he is to move into that pattern of career development. With on-the-job training and some classroom study he may move in equipment operations into another unit of the city or state for which he works and to jobs with more responsibility, even foremanship.

Occupational Summary 21

CUSTODIAN, WASTEWATER TREATMENT PLANT

DOT: 381.887

Job Description

Cleans all or designated portions of wastewater treatment plant and grounds. Performs any combination of tasks such as following, in accordance with established procedures, subject to inspection for adherence to required standards of cleanliness and compliance with instructions: Sweeps, mops, waxes, and polishes floors; washes walls and woodwork; dusts furniture, piping, valves, etc. Washes and polishes windows and metal surfaces. Empties wastecans and ashtrays. Performs general custodial duties on grounds, including picking up litter and sweeping walks. May shovel snow and cut grass. Adjusts heat and ventilating controls. Reports any repairs or adjustments required. Acts as watchman. Washes and polishes cars and trucks.

Basic Qualifications

Good physical condition; stamina; some dexterity with fingers and hands; an inclination toward routine; ability and willingness to follow instructions.

Undistinguished scholastic record. Demonstrated reliability, honesty and industry.

Additional Training

If not a high school graduate, the Custodian should attempt to complete the requirements for the GED certificate. He may gain upward mobility into higher level jobs in wastewater plan operations or maintenance work through study of the following courses.

Communication Skills
Personal and Job Behavior
Basic and Related Mathematics
Basic and Related Science
First Aid and Accident Prevention
Safety in Operation and Maintenance
Care and Use of Tools
Building and Grounds Maintenance
Automotive Equipment Maintenance

Sources of Training

On-the-job training should be coupled with classroom study to ensure growth in general abilities and in specific related knowledges and skills.

The GED may be gotten either in a program for public employees or by means of local adult basic education training offered by a high school or vocational-technical school.

Entry and Advancement

Entry to the Custodian job classification usually has no previous training requirement. Entry may be from off-the-street, or by means of help from either a private or public employment service.

Having demonstrated desirable work traits and personal desire to improve, the Custodian may be promoted to Automotive Equipment Operator, Maintenance Helper, or Maintenance Mechanic I.

Section Summary

The 21 pages of occupational summaries in this section constitute a major aspect of the overall project to develop guidelines to career development for wastewater treatment plant personnel. The summaries contain the base information from which to formulate modules of training.

In effect, the move here is from employment and recognized need for additional training to formulation of specific modules of training with which to satisfy the recognized need. It then remains for the individual worker, on his own or with help from his associates, to establish a career plan and to take the training steps required for career development. Good on-the-job experience should be coupled with training in the specific elements of wastewater treatment plant work that are "defined" in the training modules presented in the next section.

SECTION V

TRAINING FOR WASTEWATER TREATMENT PLANT OCCUPATIONS

Most succinctly, this document was designed to present information relative to wastewater treatment plant occupations and training for those occupations. The first intent was accomplished in Section III, with the 21 occupational summaries. The second intent is accomplished in this section as follows:

1. Discussion of some of the concerns in training.
2. Explanation of the essential parts of a training module.
3. Display of concise material relative to each of the modules required in the training program.
4. Examination of the relationship of training to certification of workers.

Training, as dealt with in this section, is a major part of the overall building of guidelines to career development for wastewater treatment plant personnel.

Fundamental Concerns

The first fundamental concern is with the relationship between a job and training for that job within a particular wastewater facility. Facilities which are in operation or under design and construction vary in type, or the unit processes involved. They vary for many reasons, including quality of influent, geography, climatic conditions, magnitude of flow, and design philosophy. A facility, once designed, defines the functional processes involved and the tasks required. The frequency of performance of these tasks and the length of time per performance is largely determined by the quantity and quality of the influent. The skills and knowledge requirements for the performance of these tasks is determined by their complexity, the tools and equipment involved, and the degree to which improper performance can cause loss of quality, impair treatment, or create unsafe conditions.

The jobs necessary to wastewater facility operation are composed of numerous and varied tasks. Each of the tasks may be identified by particular pieces of work essential to completion of a job objective. The information regarding tasks to be performed and pieces of work to be done form the basis for planning of the staff training program. Requirements within the training program are indicated in terms of specific skills and particular knowledges. These then are formed into teaching-learning modules with proper mixes of skill building and knowledge formation.

The second major concern here is with procedures for making the training across the board in terms of functions and job classifications served. Training for wastewater personnel, in order to be most effective, must consider and cover all occupations in the field rather than apply only to the man "controlling operation of the plant," the Operator. Too often, it is only the plant operations function that is served by training because the Operator must be "certified." The training concern should also give support to the functions of administration, maintenance, and laboratory. And there must be concern for such specilizations in the plant as clerical, storekeeping, welding, electricity, plumbing, painting, and instrumentation. Because certification of "plant operators" is recognized and much discussed, one is often left wondering about training needs of other plant staff.

The continuing training effort, available to wastewater treatment personnel, should be structured with a foundation, a general framework, and a topping-off element. Too, the training effort should contain aspects by which it is rounded out to meet unique needs of certain workers. The total training structure must contain building blocks of subject-matter content.

Structure of Traininng	Illustrative Subject-Matter
Basic	human relations, arithmetic, science, first aid, principles of wastewater plant operations, care and use of tools.
Intermediate	chemistry, biology, mathematics, accident prevention, inventory control, maintenance records, wastewater treatment, wastewater collection systems, buildings and grounds maintenance.
Advanced	treatment systems, safety program, financial reports, machinery maintenance, sludge digestion, plant management, plant evaluation, supervision of contracted work, public relations.
Specialized	clerical practices, laboratory research, welding, plumbing, painting, instrumentation, management resrources.

The foregoing is representative of the third concern for the general nature and scope of training for wastewater plant personnel.

Within the total span of environmental control, proper wastewater treatment is an important "control" measure. One mechanism for the exercise of that control is to insure that new as well as existing treatment plants function with adequate numbers of well-trained staff. It is this concept that prompts water quality boards, water utility associations, departments of health, technical institutes, and other federal and state agencies to actively promote training efforts. Through good training, standardization of wastewater treatment plant operation and maintenance may be achieved. In the interactions of training, wastewater treatment may be measured, evaluated, validated, and comparisons conducted for verifying or checking of effectiveness and efficiency. The concern for control may be faciliated and expedited by means of staff training.

The training that goes into wastewater staff career development must derive from specific jobs performed, cover preparation for all wastewater staff functions, consist of carefully structured content, and radiate elements of control over the entire occupational field. These and other concerns permeate the modular approach to the programming of training that is included in the remainder of this section.

Dimensions of the Training Module

For the purposes of this project, a training module is defined as purposeful learning experiences focused upon certain outcomes that will modify the performance of tasks and pieces of work in wastewater treatment plants. There are at least five dimensions of any training module. They include length, purpose, content, design, and processes. By elaborating on each of these dimensions, the definition of a module takes on additional clarity.

Length

How time is used in a training situation often determines to what extent the teaching-learning is geared to individual needs. The artificiality and arbitrariness of breaking training into specified time segments promotes time regimentation. It makes both instructors and trainees slaves to the clock. Some time scheduling is inevitable, but the modules for wastewater training should be varied in length to facilitate multi-media approaches to flexible kinds of instruction. The modules presented later in this section range in length from 4 to 120 hours. Most of the modules are about 20 to 40 hours in length.

Purpose(s)

Regardless of the wastewater training activity in which an individual participates, some purpose is being served. If helping to extend and refine a particular ability is a purpose of a module, then the trainee needs to be sensitive to why he is engaged in that activity. If he can see relevance in reference to his own needs, what he learns will more likely have lasting meaning for him. Ideally, purposes of training will always relate to individual needs, or proper group needs. This goal is difficult to attain, but instructors should minimize the times when all trainees are expected to carry out the same activity.

Key Content Topics

Another dimension of a training situation is the content or substantive matter with which the trainee deals. Embracing the ideal of trainee-centered learning, many of the decisions regarding what content will be studied should be made by the trainee himself. The trainee who has no choice about what he will be involved with loses a degree of freedom from his individualization and personalization. He begins to think that the training offered is just like the schooling that he avoided in the past.

Most of the modules of wastewater training are broad enough to permit trainees latitude in deciding what it is they wish to study. Each trainee can make decisions regarding the key content topics he needs to investigate. This demonstrates to the trainee that the instructor recognizes and respects his integrity as a person.

Design

The design of a wastewater module of training bears primarily on the plant function served. Thus, certain modules may be for plant administrative personnel, others for people in plant operation, in plant maintenance, or in laboratory work. There are some foundational modules that serve all trainees, regardless of their functions. There are other modules that have value for people in either operations or maintenance. The design of modules may also accent levels of training. There are modules that range into high levels of academic work, others that have years of experience as prerequisites. Again, the training program becomes trainee-centered, as individuals are steered toward or away from a module by its design.

Effective Training Processes

Training processes, the fifth dimension of a training module, should be many and varied. The teaching-learning formats should be differentiated in terms of instructional hardware and software. The nature of activities and relationships in the training group may require some rules and regulations. But, these should be kept to the minimum. It is the relevancy of a training regulation that will determine whether it will be observed.

Another aspect of the processes dimension of a training module is the facility, consisting of space, materials, and equipment. The facility may be the wastewater plant, a classroom nearby, a mobile training unit, an auto in which the trainee is riding with an instructor, or the trainee's home. These are actually only a few of the varied locations where teaching-learning may take place. The trainee should be convinced that their learning about wastewater will not be confined to a classroom, or restricted to only specified materials and equipment.

Assessing of the trainee's growth in terms of how it was affected by the activities in a training module is a form of evaluation. But, much more important in the wastewater training program, is the thing referred to as "retention." In this case, retention involves both the training and the job. The trainee should be hired and trained. Retention becomes a matter of the completion of a training program and continued employment. Retention, in truth, is career development and longevity in that career.

It may be assumed that the five aforementioned dimensions of training modules are fully applicable to preparation for wastewater treatment plant occupations. It is, therefore, feasible now to present 46 modules of training built with these particular dimensions. The 46 modules constitute the total wastewater training program for preparing people to work in the 21 job classifications presented in Section III. The program is concerned with providing the learning environment that will help each worker achieve self-fulfillment and, at the same time, acquire useful information, skills, and attitudes. Ideally, the environment for each module of training will be simplified, systematized, and edited.

Wastewater Training Modules

The broad reason for the preparation of modules of training for wastewater treatment plant personnel was to build a training ladder to career development. There was desire to help people who want jobs in the area of wastewater treatment, as well as to help people who already hold such jobs—the entry and upgrade approach. Thus, there was a dual intent in the preparation of the modules. The first intent was to point the way toward organized training for entry employees to insure that:

1. The entry worker is effective while learning his job. He does not waste his time and his output is more than adequate.
2. He does not waste the time of fellow workers with questions and seeking of help in doing his job.
3. Supervisors and management do not waste time in repeating instructions.
4. He efficiently and with care uses capital equipment at his disposal.
5. He does not damage materials and equipment with resulting costs.
6. He remains in his job over a long period of time, thus avoiding cost of high labor turnover.

The second intent of the preparation of training modules was to point the way toward organized training for upgrading of employees to insure that:

1. Public health will be protected; better wastewater treatment.
2. Supervisors may readily select and promote plant workers whose competence has been determined.
3. Professional and technical proficiency of workers will be established at a high level with boosted morale and professional feelings.
4. Plant will be operated in full accord with its design and efficiency.
5. Employment of operators and maintenance men will be stable and public confidence in wastewater treatment maintained.
6. Regulatory agencies may properly exercise control and discipline because workers meet or surpass the requirements for certification and/or licensing.

Behind the entire effort in this project was the idea that organized training is a tool of management. Purposeful training is effective in reducing labor costs and improving output.

Forty-six modules of training for work in conventional wastewater treatment plants were prepared. They were prepared in the subject-matter pattern indicated on the next page.

Sequence and Content Pattern of Training

Modules for Wastewater Treatment Plant Occupations

Personal Development

1. Orientation
2. Communication Skills
3. Personal & Job Behavior
4. General Education Development

Mathematics

5. Basic & Related Mathematics
6. Mathematics for Operators & Supervisors

Science

7. Basic & Related Science
8. Chemistry of Wastewater
9. Treatment Systems
10. Laboratory Records & Reports
11. Laboratory Procedures
12. Laboratory Research

Health & Safety

13. First Aid & Accident Prevention
14. Safety in Operation & Maintenance
15. Safety Program

Clerical & Recordkeeping

16. Clerical Practices
17. Typewriting Applications
18. Records Management
19. Recordkeeping & Inventory Control
20. Records for Operation & Maintenance
21. Financial Reports

Maintenance

22. Care & Use of Tools
23. Buildings & Grounds Maintenance
24. Preventive & Corrective Maintenance
25. Mechanical Maintenance
26. Gas & Arc Welding
27. Electrical Maintenance
28. Plumbing Maintenance
29. Painting & Other Protective Maintenance
30. Automotive Equipment Maintenance

Operation

31. Wastewater Plant Operation
32. Wastewater Treatment
33. Wastewater Collection Systems
34. Sludge Digestion
35. Operation of Automotive Equipment
36. Electrical Systems
37. Instrumentation

Supervision & Management

38. Principles of Plant Management
39. Procurement of Materials & Supplies
40. Supervision of Maintenance
41. Supervision of Contracted Work
42. Plant Regulations & Quality Standards
43. Employment & Training of Staff
44. Plant Evaluation & Work Economy
45. Wastewater Management Resources
46. Wastewater Public Relations

The training modules are presented in sequence, 1 through 46, on pages 55-100.

Preparation for Jobs in Wastewater Treatment

Module 1	**ORIENTATION**
Length	24 to 40 hours, preferably concentrated in one week.
Purposes	To help the trainee become part of manpower development so that he makes the most of the personal and job improvement elements. To help the trainee better see himself as a wastewater treatment worker and to understand his obligations to himself and to his employer. To help the trainee get the "feel" of the training and advancement opportunities available to wastewater treatment plant workers.
Key Content Topics	1. Definition of lines of authority in employment and career development. 2. Identification of training facilities and sites. 3. Explanation of the roles fulfilled by the instructors, counselors, supervisors, foremen, and others involved with training. 4. Background of wastewater treatment as a major area of employment. 5. Rights and obligations of wastewater treatment plant workers. 6. Advantages and disadvantages of wastewater treatment jobs. 7. Testing and assessment of the trainee's capabilities and capacities in counseling circumstances. 8. Development of a career plan aimed at achievement of job security.
Design	For people new to either entry or upgrade training.
Effective Training Processes*	Explanatory remarks and presentations. Interpretive study of rules, regulations, and policies. Viewing of films on aspects of pollution. Preliminary assessment of trainee's abilities. Informal staff-trainee coffee breaks and luncheon sessions. Formulation of plans for providing support services. Completion of forms for enrollment in training. Clarification of job tasks and training needs. Past performance review and feedback in counseling sessions. Warm-up, get-acquainted counseling activities. Question-and-answer sessions. Listening and discussion of motivational cassettes. Personal action planning.

*There is no significance in the sequence of the processes in each module. No process is necessarily more effective than another. The processes take on relative levels of importance in the judgment of the instructor and in the opinion of the trainee.

Preparation for Jobs in Wastewater Treatment

COMMUNICATION SKILLS

Module 2

Length

16 to 24 hours, basic module.

Note – This module of training may be expanded to 96 hours (12 days) or more in response to needs of disadvantaged trainees. If this is done, the training might include:

Basic Module 2	24
English As A Second Language	52
Use of Numbers in Communications	20
Total	96

Purposes

To help the trainee extend and refine his ability to communicate.

To give direction to the trainee in the use of his communication skills in wastewater treatment plant work.

Key Content Topics

1. Reading for understanding.
2. Writing for clarity.
3. Relating speaking to thinking in conversation.
4. Listening with perception.
5. Proper techniques for study and learning.
6. Applications in terms of history of wastewater treatment; economics of pollution; government funding of plant construction and staff training.

Design

Primarily for operations and maintenance people who need effective communication in doing their jobs.

Effective Training Processes

Laboratory reading practice.
Word power development practice (spelling and meaning).
Writing drills and exercises.
Small-group discussions.
Fill-in practice with printed forms.
Independent listening to cassette tapes.
Practice in the interpretation of written instructions.
Discretionary reading in class and at home.
Completion of workbook drills.
Oral reports by trainees.
Structured practice in how to take notes.
Recording of conversations with analysis of playback.
Promote participation in public speaking groups of clubs.

Preparation for Jobs in Wastewater Treatment

Module 3	**PERSONAL AND JOB BEHAVIOR**
Length	8 to 16 hours.
Purpose	To help the trainee assess his own pattern of living and plan improvements both at home and at work.
Key Content Topics	1. Fundamemtals of worker-employer relationships. 2. Job security: wage system, fringe benefits, etc. 3. Career ladders and plans for job development. 4. Using the resources of your community. 5. You and the law. 6. Management of your income and expenses. 7. Determining and fulfilling your community obligations.
Design	Fundamental to all training programs, whether entry or upgrade.
Effective Training Processes	Critiques of behavioral patterns, on and off jobs. Viewing and discussion of money management films. Lectures with transparency illustrations. Home study with members of family participating. In-depth presentations of certain topics by consultants. Trainee survey of career development resources available in the community. Trainee analysis of community obligations. Study and discussion of worker-employer relations and aspects of job security. Independent and discretionary reading. Question-and-answer discussions. Definition of primary kinds of decisions in personal and job behavior situations.

Preparation for Jobs in Wastewater Treatment

GENERAL EDUCATIONAL DEVELOPMENT (GED)

Module 4

Length 40 to 120 hours (much additional independent study may be associated with these hours under the supervision of the instructor).

Purpose To help the trainee, who has not graduated from high school, acquire the knowledge and test-taking ability required for passing the test for the High School Equivalency Diploma.

Key Content Topics

1. Develop acquaintance with the kind of examination that the GED tests represent.
2. Improve the skills fundamental to taking examinations.
3. Acquire, through both class and independent study, greater knowledge and understanding in the particular fields of:
   - a. Vocabulary.
   - b. Grammar.
   - c. Spelling.
   - d. Arithmetic.
   - e. Problem solving.
4. Special emphasis on analyzing and answering questions that involve reasoning, judgment, comparison, and evaluation.
5. Much reading, particularly in efforts to develop better understanding of what is read.

Note – When, in the opinion of the instructor, the trainee is ready to again, or for the first time, take the GED test, the schedule for doing so will be arranged.

Design A concentrated approach to general learning for those persons highly motivated toward obtaining the high school equivalency diploma.

Effective Training Processes

Pre-training taking of GED test to determine directions instruction and learning must take.
Laboratory work in reading and computational skills.
Individual and group interpretation of literary materials.
Test-taking practice.
Practice in reasoning, making comparisons, arriving at judments, and in evaluating.
Individual analysis of one's deficiencies in academic areas.
Tutorial kinds of service to meet individual needs.
Extensive independent reading directed by the instructor.
Completion of drills and exercises in workbooks.
Motivation of learning through recognition given by instructor.
Post-training taking of GED test (repeat study and testing until all parts are passed).

Preparation for Jobs in Wastewater Treatment

Module 5

BASIC AND RELATED MATHEMATICS

Length

24 to 72 hours (time range determined by abilities of trainees).

Purposes

To help the trainee refresh his knowledge of fundamental mathematics.

To help the trainee develop the ability to make applications in plant operations and maintenance.

Key Content Topics

1. Establishment of the trainee's level of ability in mathematics (survey and diagnostic assesment).
2. Review of the fundamental arithmetic of whole numbers, common fractions, and decimal fractions.
3. Use of tools and rules for precision measuring.
4. Wastewater measurement of: lines, surfaces, angles, circles, capacities, velocities, pressures, weights, percentages, and time factors.
5. Special wastewater mathematical terms, equivalents, conversions and formulas.
6. Wastewater graphic materials: drawings, maps, diagrams, flow charts, blueprints, etc.
7. Desk-size computing machine applications.

Design

Primarily for operations and maintenance staff who need mathematics as a foundation for more advanced learning.

Effective Training Processes

Thorough review of mathematical subskills.

Computation practice with laboratory kits.

Instructor-directed study of the tools and rules for precision measuring.

Demonstrations of use of folding rule, steel tape, caliper, etc.

Completion of instructor-prepared drills and exercises.

Use of overlays and slides depicting graphic materials.

Use of easy-to-difficult (serial ordering, adding, subtracting, multiplying, dividing, fractions, and beyond) approach to wastewater arithmetic.

Testing to show trainee progress (for grade only is absolutely required in particular program).

Preparation for Jobs in Wastewater Treatment

MATHEMATICS FOR OPERATORS AND SUPERVISORS

Module 6

Length 24 to 36 hours

Purpose To help the trainee become fully competent to handle wastewater measurements and computations.

Key Content Topics

1. Review of wastewater mathematical terms, equivalents, and conversions.
2. Review of the techniques and procedures in using graphic materials to convey wastewater information and data.
3. Development and application of wastewater treatment formulae:
    a. Area of surface.
    b. Capacity of tanks.
    c. Detention time in sedimentation tanks.
    d. Overflow rate or surface loading.
    e. Trickling filter hydraulic dosing rate.
    f. Trickling filter BOD loading.
    g. BOD removal.
    h. Suspended solids.
    i. Volatile matter.
    j. Sludge index.
    k. Population equivalent based on BOD load.
    l. Weir overflow rate.
    m. Chemical dosages.
    n. Volume of sludge remaining after digestion.
    o. Composite sample.
4. Use of wastewater mathematics in a field study.

Design For the experienced worker in any functional category of wastewater treatment.

Effective Training Processes

Instructor-directed review of wastewater mathematical terms, equivalents, and conversions.

Individual practice in techniques of using drawings, graphs, charts, etc., in conveying wastewater information.

Lectures with overlays to present wastewater formulae.

Independent and/or homework study of formulae and their uses.

Use of the simple-to-complex (recognizing, recalling, understanding, applying, problem solving, analyzing, synthesizing, and evaluating) approach to wastewater mathematics.

Evaluation of trainee progress (preferably self-evaluation and not for grading purposes).

Solving by trainees of special wastewater treatment problems drawn from manuals and other references.

Manipulation drills and exercises with machines having adding-listing and calculating capabilities.

Application of skills and knowledges in a field study.

Preparation for Jobs in Wastewater Treatment

Module 7

BASIC AND RELATED SCIENCE

Length	12 to 16 hours.
Purpose	To help the trainee develop a foundation for understanding the science aspects of wastewater treatment processes.
Key Content Topics	1. Plant and animal life. 2. Energy in machines. 3. Energy in electricity. 4. Organic and inorganic constituents of wastewater. 5. Disease and nuisance producing organisms of wastewater.
Design	Primarily for operations and maintenance staff who need to understand the fundamental biological and science aspects of their work.
Effective Training Processes	Teacher-directed learning of basic science. Independent, self-directed study of elements of special interest to the trainee. Presentations with transparencies relating to chemistry, biology, electricity, and machines. Trainee observation, experimentation, manipulation of equipment, and evaluation (within limitations of time, facilities, and trainee interest). Instructor-trainee discussions drawing out direct experiences from the wastewater job environment. Development of the inquiry/discovery frame of reference. Viewing of film(s) on science aspects of wastewater treatment or control of pollution.

Preparation for Jobs in Wastewater Treatment

CHEMISTRY OF WASTEWATER

Module 8

Length	24 to 32 hours
Purpose	To help the trainee fully understand the nature and scope of the elements of science in the handling and processing of wastewater.
Key Content Topics	1. Review of the physical and chemical properties of wastewater. 2. Carbon, sulfur, and nitrogen cycles. 3. The role of enzymes. 4. Hydrolysis. 5. Morphology and metabolism of organisms and indicator organisms in wastewater. 6. Applications of chemistry in the secondary treatment processes. 7. Taxonomic relationships.
Design	This module is for wastewater personnel who desire to increase their knowledge of the science applications in their work.
Effective Training Processes	In-depth lectures with demonstrations by instructor. Completion of chemistry experiments in mobile or plant laboratory. Study of slides of various stages of wastewater treatment. Study plant design and layout of where chemistry functions in wastewater treatment. Small-group analysis and discussion of the chemical reactions essential to wastewater treatment. Extensive use of localized, instructor-prepared transparencies, structured exercises, and chemistry problems.

Preparation for Jobs in Wastewater Treatment

Module 9	**TREATMENT SYSTEMS**
Length	40 hours (additional time may be used for observation activities).
Purpose	To help the trainee acquire in-depth knowledge of the technical aspects of wastewater treatment.
Key Content Topics	1. Review of the systems for wastewater treatment. 2. Advanced study of the chemical and biological factors that affect wastewater treatment. 3. Analysis processes used in plants where trainees are now working or expect to work: a. Determination of Biochemical Oxygen Demand. b. Determination of dissolved oxygen, relative stability, and chlorine demand. c. Settleable, suspended, dissolved volatile, and total solids. d. Chloride, pH, and hydrogen sulfide determinations. e. Ammonia, nitrite, and nitrate nitrogen determinations. 4. Field trips as needed to gather data and information and for actual observations of treatment processes.
Design	For wastewater personnel who need and want to know what really happens when a valve is turned, a gate is opened, a pump is started, or a solution is added.
Effective Training Processes	Pre-training test to establish base from which learning must proceed. Lectures in association with transparencies, slides, or film. Directed and independent reading from manual (s) on wastewater treatment processes. Discussions about cause-and-effect relationships. Laboratory activities in simulated, mobile, or actual plant situations. Clarification of the relationship of treatment processes to plant design and functions. Exchange of ideas about treatment processes between trainees. Field trip that will permit 6 to 8 hours in one or two plants. Use summary discussion with question-and-answer session to close out the module.

Preparation for Jobs in Wastewater Treatment

Module 10

LABORATORY RECORDS AND REPORTS

Length

24 hours.

Purposes

To help the trainee learn how to establish and keep the complete and accurate records required for proper wastewater treatment plant supervision and management.

To make apparent and emphasize the laboratory technician's role in the maintenance of a high level of wastewater treatment plant efficiency.

Key Content Topics

1. Nature and scope of wastewater laboratory records and reports.
2. Daily laboratory work sheet: BOD data, weather conditions, temperature records, precipitation and hydrological data, plant effluent coliform density, chlorine and other chemicals used, and all items of test.

   Weekly records: digester gas analysis, receiving stream survey for both above and below the plant outfall, and so forth.
4. Monthly operation report to the water pollution control agency, if required; for use of plant superintendent in any case.
5. Use of exchange of monthly records with other plants.
6. Summation of monthly records to a maximum, minimum, and average form.
7. Laboratory records and reports as reliable continuing record of proof of the cause, as and if needed by the Plant Superintendent, state regulatory agencies, municipal officials, and others.

Design

For administrative, laboratory, and/or operations staff who must prepare, interpret, or otherwise be concerned about laboratory records and reports.

Effective Training Processes

Explanations of uses and significance of records and reports.

Analysis and interpretation of actual records and reports drawn from particular plants.

Structured exercises in partial or complete preparation of specified reports.

Study and discussion of how records and reports are channeled and their significance at various levels.

Small-group critiques of records kept and reports made.

Discussion of relevance of specific records and reports.

Preparation for Jobs in Wastewater Treatment

Module 11

LABORATORY PROCEDURES

Length

24 hours, plus variable time for pilot studies.

Purposes

To help the trainee learn and apply the laboratory techniques essential to wastewater treatment.

To provide simulated or integrated project activities for those trainees who do not have jobs wherein they can practice laboratory procedures.

Key Content Topics

1. Fundamental laboratory procedures and processes.
    a. Apparatus, reagents, and techniques.
    b. Expression of results.
    c. Achieving precisions and accuracy in measurements, calculations, and statistical presentations.
2. Physical, chemical, and biological assays of wastewater, effluents, bottom sediments, and sludges.
3. Examination of wastewater for radio-activity.
4. Ancillary equipment and facilities.
5. Laboratory design criteria in particular plants.
6. Laboratory safety.

Design

Primarily for the laboratory technician who needs advanced technical training in specific procedures.

Effective Training Processes

Trainee self-evaluation of need for training.
Simulated and/or actual demonstrations of procedures.
Independent study with class review of nomenclature of supplies and equipment.
Hands-on experience with supplies and equipment.
Develop understanding through practice of procedural step sequencing and establishment of system.
Perform pilot study with two or three procedures in a particular wastewater plant.
Emphasize trainee-centered learning with guidance from instructor.

Preparation for Jobs in Wastewater Treatment

LABORATORY RESEARCH

Module 12

Length	80 hours (32 in classroom; 48 in directed laboratory research).
Purposes	To help trainee learn how to conduct careful, systematic, patient studies and investigations relating to the efficiency and effectiveness of wastewater treatment systems and processes. To help the trainee refine and enhance his skills and abilities in the actual doing of laboratory research.
Key Content Topics	1. Research-oriented problems in wastewater treatment. 2. Experimental measurement of variables. 3. Development of data in laboratory research circumstances. 4. Special problems having direct implications for the trainee.
Design	Primarily for, and usually restricted to, staff who will perform laboratory research in the larger wastewater plants.
Effective Training Processes	Explanatory lectures and illustrative presentations of research methods and techniques. Directed and independent study of research models and reports. Small-group application of research skills: imagination, analysis, classification, comparison, and inference. Use inquiry/discovery approach to develop with each trainee certain topics for study. Each trainee design a research-oriented project. Analysis of the experimental measurements applicable to handling variables in wastewater treatment. Individual or team research into a problem of immediate concern.

Preparation for Jobs in Wastewater Treatment

Module 13	**FIRST AID AND ACCIDENT PREVENTION**
Length	8 to 12 hours
Purposes	To help the trainee develop knowledges and skills for emergency care of injured persons. To promote in the trainee interest in the prevention of accidents. To firm up in the trainee attitudes that will insure his following of safety precautions.
Key Content Topics	1. Standard first aid procedures for: wounds, artifical respiration, bandaging, immobilization, rescue and transfer. 2. General safety in terms of: kinds of hazards, precautions to prevent accidents, and reporting of accidents. 3. Fire prevention and extinguishment.
Design	Fundamental to all training programs, whether for entry or upgrade trainees.
Effective Training Processes	Use American Red Cross multi-media first aid course with: textbook, workbook, 16mm color film (Reference 8). Teaching by **certified** instructor. Issue first aid certificates to trainees who pass examination. Independent reading on accident prevention. Viewing of film (s). Practice use of first aid supplies and devices.

Preparation for Jobs in Wastewater Treatment

SAFETY IN OPERATIONS AND MAINTENANCE

Module 14

Length 8 to 16 hours.

Purposes

To help the trainee understand that health hazards, accidents, and preventative measures must be of constant concern to him.

To build in the trainee solid respect for safety precautions and willingness to continually practice safety.

To help the trainee comprehend the relevance and need for safety programs and participation in them.

Key Content Topics

1. Techniques for the prevention of physical injuries.
2. Recognition of health hazards and practice in the use of preventive measures.
3. Reporting of accidents.
4. Plans for compensation for sickness and accident time losses.
5. Housekeeping and general maintenance for safety.
6. Special aspects of vehicular safety applicable to the job.

Design For all employees in wastewater treatment plants.

Effective Training Processes

Instructor lectures with transparencies applicable to wastewater plant hazards.
In-class and independent study of safety reading materials, including those locally produced.
Viewing of safety films with follow-up discussions.
Job-site observation of safety hazards and remedies.
Hands-on practice with safety devices.
Presentations by safety expert; dialogue with trainees.

NOTE: In addition to training in safety in Modules 13, 14, and 15, there is concern about safety in all other modules in the training program wherein specific applications may be made. Such applications relate to mechanics of operation and maintenance, to handling of chemicals, to bacterial contacts, and to laboratory activities.

Preparation for Jobs in Wastewater Treatment

Module 15

SAFETY PROGRAM

Length 16 to 20 hours.

Purpose To help experienced wastewater treatment plant operators, maintenance men, and supervisors learn how to initiate and continually promote the safety program.

Key Content Topics

1. Responsibilities of management and staff for the safety program.
2. Organization of the safety program.
3. Elements in the program that must be continually emphasized.
4. Techniques for motivating workers to participate fully in the safety program; including disciplinary action, if needed.
5. Maintenance of safety records—classification of accidents, analysis and tabulation, uses of health and accident information.
6. Full compliance with plant, community, and state regulations regarding safety.

Design Primarily for those foremen and supervisors having responsibility for developing and continuously conducting plant safety programs.

Effective Training Processes

Classroom study of existing safety programs with explanations.
Individual or group designing of a program.
Practice by trainees in presenting safety ideas and materials.
Thorough independent reading of OSHA materials, especially the **Safety Inspection Guide**, Chapter 13, of Handbook (Reference 9).
Group questioning led by OSHA expert.
Viewing of slides, transparencies, or film(s).

Preparation for Jobs in Wastewater Treatment

CLERICAL PRACTICES

Module 16

Length

24 to 64 hours (range determined by abilities of trainees).

Purposes

To help the trainee learn how to routinely perform the fundamental clerical practices and procedures.

To help the trainee develop the clerical knowledges and skills that are unique to the office services required to maintain and operate a wastewater treatment plant.

Key Content Topics

1. Review of basics: comparing, verifying, proofreading, posting, computing, sorting, etc.
2. How to establish and maintain office routines and schedules.
3. Meeting the public in person and by telephone.
4. Handling incoming and outgoing mail.
5. Preparation of tables, reports, requisitions, and other matter.
6. Composition of routine correspondence and memorandums.
7. Using references and other sources of information.
8. Operation of adding-listing, calculating, and duplicating machines.

Design

Primarily for individuals doing routine clerical office tasks in the wastewater treatment field.

Effective Training Processes

Intensive classroom and independent study and practice with civil service type materials.
Hands-on, learning by doing, activities; utilize real materials and jobs.
Varied homework in terms of individual trainee needs.
Practice with clerical equipment and machines to the extent possible.
Pre-test, then evaluate with the trainee his daily progress toward pre-determined skill goals.
Simulate office clerical procedures and tasks.
Utilize film(s), film strips, etc.
Minimal lecturing; emphasize trainee participation.

Preparation for Jobs in Wastewater Treatment

Module 17

TYPEWRITING APPLICATIONS

Length	50 to 90 hours (range due to whether trainees must start with Item 1, 2, or 3 below).
Purposes	To help the trainee review his knowledges and manipulative techniques in typewriting. To help the trainee develop specific skills in the applications of typewriting in the office service aspect of wastewater treatment plant operations and maintenance.
Key Content Topics	1. Fundamentals of typewriting with rapidity and control. 2. Practice in typewriting the simpler materials of wastewater operations and maintenance: memorandums, short letters, uncomplicated forms, reports with limited tabulations, etc. 3. Practice in typewriting more difficult materials of wastewater operations and maintenance: more complicated letters and forms, lengthy reports, statistical tabulations, and the handling of unfamiliar materials. 4. Mastery of the technicalities related to production of much typewritten material with such unique elements as wastewater formulas, abbreviations, symbols, and format styles.
Design	For Clerk Typist, Storekeeper, Laboratory Technician, or others who need typewriting ability in the performance of jobs.
Effective Training Processes	Selective practice techniques to promote individualized, rather than mass, procedures. Trainee progress through routine practice materials under domination of instructor signals. Actual wastewater work exercises brought in from the plant to promote interest. Problem assignments completed under the pressure of time. Trainee selection of learning materials based on his own needs. Trainee practice in composing material at the machine. Emphasize remedial practice until ability to handle move to problem typewriting is developed.

Preparation for Jobs in Wastewater Treatment

RECORDS MANAGEMENT

Module 18

Length	24 to 48 hours.
Purposes	To help the trainee learn or review the principles of alphabetic and subject filing, as the basis for clerical work in wastewater treatment plants. To help the trainee develop the specific skills and unique knowledges required for managing wastewater plant operations, maintenance and administration records.
Key Content Topics	1. Fundamentals of alphabetic and subject filing methods. 2. Essentials in the organization and control of the records system for a wastewater treatment plant. 3. Procedures for retention, review, and disposal of filed materials. 4. Microfilm, mechanized, and electronic devices for interpretation and control of information. 5. Observation and practice in the use of systematized records programs for wastewater treatment plants.
Design	Primarily of value to the Clerk Typist and Storekeeper.
Effective Training Processes	Hands-on practice with actual or simulated filing materials and equipment. Directed or programmed study of filing rules and fundamental procedures. Viewing and follow-up with filmstrip set material. Instructor presentations and explanations of filing systems; alphabetic, subject, numeric, etc., as applicable to wastewater field. Analysis of control of files; particularly the disposal of records. Exploration of techniques for selecting and obtaining filing equipment and supplies.

Preparation for Jobs in Wastewater Treatment

Module 19

RECORDKEEPING AND INVENTORY CONTROLS

Length

24 to 48 hours (24 hours is required for each of the Purposes below).

Purposes

To help the trainee acquire entry—job skill in the procedures for keeping financial records; to introduce him to the fundamental elements of accounting.

To help the trainee acquire entry-job skill in maintaining wastewater plant inventory records and controls.

Key Content Topics

1. Principles of recordkeeping applicable to wastewater treatment plant operations and maintenance.
2. Requisitioning, receiving, identifying, inspecting, verifying of supplies and equipment in terms of quantity, quality, and adherence to specifications and standards.
3. Storing and issuing of materials, supplies, tools, and equipment; maintenance of inventory.
4. Preparation of financial reports; compilation of records and reports of materials used, spoilage or other losses, inventory adjustments, and refusal of shipments.
5. Uniform system of accounts for wastewater treatment plants.

Design

For the Storekeeper and supervisors or other administrators responsible for inventory.

Effective Training Processes

Instructor-directed completion of stock control practice set.

Explanations of wastewater applications with transparencies of plant records, stock control forms, requisitions, reports, etc.

Reading assignments in general recordkeeping textbook materials.

Follow-up disucssions of reading done by individuals.

Simulated problem in inventory control with actual wastewater plant forms and other materials.

Preparation for Jobs in Wastewater Treatment

RECORDS FOR OPERATIONS AND MAINTENANCE

Module 20

Length 20 hours.

Purposes

To help the trainee learn how to keep the records required for writing treatment plant efficiency reports.

To help the trainee learn how to keep the records required for preventive and corrective maintenance.

Key Content Topics

1. Development of systems for evaluation of plant performance and controlling maintenance costs.
2. Operation records.
   a. Daily: operator's worksheet, operator's log, laboratory worksheet.
   b. Weekly: lubrication record, digester gas analysis, receiving stream survey.
   c. Monthly: report to the water pollution control agency, report to administration.
   d. Annually: summation report showing maximum, minimum, and average data.
3. Equipment records; plant manual, equipment inventory, maintenance data card, work requisition form.
4. Laboratory records on flow, solids, BOD, etc.

Design

For workers in plant operation and in plant maintenance who need understanding of records in moving upward in plant job categories.

Effective Training Processes

Pre-testing and identification of trainee needs.
Completion of structured exercises with plant records.
Critique of records in a particular plant and uses made of those records.
Instructor lectures in association with reading from wastewater manuals or textbooks.
Discretionary reading from manuals other than the basic text material for the class.
Compare nature and scope of records in older plants with the newer ones.

Preparation for Jobs in Wastewater Treatment

Module 21

FINANCIAL REPORTS

Length 24 hours.

Purpose To help the trainee learn how to prepare and interpret the financial reports essential to wastewater treatment plant management and administration.

Key Content Topics

1. Style and format of financial reports.
2. Sources of financing and preparation of reports relative to:
    a. Revenue from taxes, contributions in aid of construction, sales of bonds, etc.
    b. Revenue from customers (wastewater rates).
3. Allocation of costs as bases for preparation of rate schedules or other purposes.
    a. Allocation of operating costs.
    b. Allocation of capital costs.
    c. Allocation of personnel costs.
    d. Determination of benefit-cost ration.
4. Preparation of annual budget requests and annual financial reports to the administration.

Design For plant supervisors and superintendents who must work with budgets and financial reporting.

Effective Training Processes

Seminar experiences in the formation of budgets and interpretation of reports.
Small group study of co-workers' materials.
Synthesis of ideas.
Practice in simulated decision-making on financial concerns in wastewater plants.
Transactional analysis aspects of wastewater accounting and financing.
Determination of how and when to use cost reduction techniques.
Application of budget appraisal precedures.
Use of tables and graphs to present financial data.

Preparation for Jobs in Wastewater Treatment

Module 22

CARE AND USE OF TOOLS

Length 16 to 24 hours.

Purpose To help the trainee become familiar with both hand and power tools and to begin the development of ability to use them.

Key Content Topics

1. Hand tools.
    a. Measuring and layout.
    b. Striking tools.
    c. Screwdrivers.
    d. Wrenches and pliers.
    e. Drilling and boring tools.
    f. Saws.
    g. Hand rods.
2. Power tools.
    a. Drilling.
    b. Turning.
    c. Milling.
    d. Grinding.
    e. Shaping.
    f. Power rods.
3. Use of patterns, dies, jigs, fixtures, cutters, gages, etc.
4. Use of special electrical and plumbing tools.
    a. Voltmeters and ammeters.
    b. Micrometers.
    c. Portable pumps.
    d. Grease guns.
5. Responsibility for use and care of tools.
6. Safety measures and precautions in the use of both hand and power tools.

Design For workers in entry jobs such as Laborer or Mechanic Helper and others for the first time in jobs in a wastewater plant.

Effective Training Processes

Emphasize both directed and individual learning of terms and nomenclature.
Instructor presentations with transparencies of tools, both hand and power.
Oberservation of safety film(s) and follow-up discussions in small groups.
Observation of films and slides provided by power-tool manufacturers.
Study of instructor-prepared hand and power tool materials with wastewater applications.
Hands-on manipulation of tools.
Test knowledge of tools and their uses.

Preparation for Jobs in Wastewater Treatment

Module 23 BUILDINGS AND GROUNDS MAINTENANCE

Length 24 to 32 hours.

Purposes

To help the trainee understand the tasks and the repetitive work schedule required to keep a wastewater plant in top condition.

To promote growth of pride in the trainee as he contributes to the maintenance of a valuable facility.

Key Content Topics

1. Custodial work in the plant.
    a. Supplies and tools.
    b. Floors, walls, ceilings, and windows.
    c. Light fixtures, radiators, and air conditioners.
    d. Care and upkeep of cleaning equipment.
    e. Disposal of contaminated and general waste materials.
2. Adjusting heat and ventilation.
3. Custodial work outside the plant.
4. Simple repairs and adjustments both in the plant and outside.
5. Reporting of wear-and-tear, damage, etc.
6. Safety.
    a. General practices.
    b. Disaster/fire safety.

Design For the Custodian or Laborer new to employment in a wastewater plant.

Effective Training Processes

Instructor explanations of uses of supplies and equipment.
Hands-on learning with supplies and tools of the job.
Instructor presentations with slides or transparencies to show job problems and situations.
Directed reading from manuals, bulletins, procedural statements, etc.
Question-and-answer sessions on "ways of doing".
Practice in following directions and adhering to repetitive routines.

Preparation for Jobs in Wastewater Treatment

Module 24

PREVENTIVE AND CORRECTIVE MAINTENANCE

Length

32 to 40 hours.

Purposes

To help the trainee gain the most basic knowledges and skills required in the doing of maintenance work.

To help the trainee fully understand the importance of his role in keeping the plant at peak efficiency.

Key Content Topics

1. The tools of maintenance.
2. Stocking of materials for maintenance.
3. Planned and preventive maintenance program and schedule.
    a. Draining of tanks and channels.
    b. Combating corrosion.
    c. Checking of float and electrode switches.
    d. Inspecting and lubricating: pumps, gates, valves, meters, and electric motors.
4. Break-down and emergency maintenance.
    a. Unplugging of pipelines, pumps, and valves.
    b. Repair of conversion and readout instruments and controls.
5. First aid and accident prevention; particularly what to do in case of electric shock.

Design

For plant operators as well as plant maintenance people. In particular, the design emphasizes the ways and the extent to which plant operation is dependent upon good plant maintenance.

Effective Training Processes

Instructor analysis of maintenance processes and procedures with question-and-answer follow-up.

Instructor-trainee study of specific tasks in maintenance and scheduling thereof.

Simulation of maintenance problems with solutions to be determined by the trainee or a small group of trainees.

Explanations by trainees of the steps to take and key points in performing particular maintenance tasks.

Use smoke-out questions by instructor to make certain that trainees fully understand.

Utilize film(s), slides, and transparencies.

Hands-on practice in basic tasks.

Preparation for Jobs in Wastewater Treatment

Module 25

MECHANICAL MAINTENANCE

Length	40 hours.
Purpose	To help the trainee learn the detailed procedures and techniques of keeping plant machinery in top working condition.
Key Content Topics	1. Manufacturer's design of machine in relation to maintenance of it. 2. Working relationships between plant mechanics and plant operators. 3. Use and care of repair shop facilities. 4. Pump packing; lubrication; shut down and start up. 5. Electric motors and electrical controls. 6. Belt and chain drives; couplings. 7. Valves and gates. 8. Controlling mechanical maintenance with records and cumulative data. 9. Safety precautions around machinery.
Design	To provide in-depth, advanced knowledge and skill development for plant mechanics and operators. Directed toward individual growth that will result in job advancement.
Effective Training Processes	Intensive presentations by instructor. Presentations by "expert" plant mechanic. Directed and independent reading of plant manual and machinery manuals. Use job instruction training approach with "telling alone" demonstrations of how to make repairs. Explanation and demonstration of how a mechanical device works—a pump or a valve, etc. Utilize pictures, slides, transparencies, mock-ups. Small-group discussion of salient point or points in each illustration of maintenance. Hands-on practice with instructor or supervisor inspecting results of work done. Use of inquiry-discovery technique with symptons of mechanical malfunction and determination of needed repairs.

Preparation for Jobs in Wastewater Treatment

GAS AND ARC WELDING

Module 26

Length

32 to 56 hours (32 hours for achievement of ability in oxyacetylene welding; 24 additional hours in arc welding).

Purposes

To help the trainee learn the fundamentals of oxyacetylene welding and develop minimal skill in the use of the cutting torch.

To help the trainee learn the fundamentals of arc welding and develop minimal skill striking an arc, running a bead, and making flat butt welds.

Key Content Topics

1. Safety and orientation to welding.
2. Types of welding equipment; care and uses.
3. Oxyacetylene welding.
    a. Adjusting valves, gauges, and flames.
    b. Use of the cutting torch.
    c. Fusion welding.
    d. Braze welding.
4. Arc welding.
    a. Sources of electricty and the welding circuit.
    b. Starting an arc and running beads.
    c. Butt, fillet, and corner welds.
    d. Welding beads and joints on pipe.
    e. Position welding.
5. The unique hazards in welding and safety measures required to overcome them.

Design

For the person who wants to learn a special skill to broaden his ability as a plant mechanic or to enable him to advance by means of a job as a welder.

Effective Training Processes

Instructor demonstrations to the whole class, smaller groups, and individuals.

Approach the teaching-learning through brief job units that are focused on actual performance.

Substantial hands-on use of welding equipment and materials.

Independent study of handbooks, equipment bulletins, etc. Time the only limitation.

Trainee performance measured against a review of the demonstration by the instructor.

Theory and technology of welding expanded in terms of time available and ability of the individual trainee.

Evaluation accomplished in question-and-answer sessions without pressure and by observation of the work done by each trainee.

Preparation for Jobs in Wastewater Treatment

Module 27	**ELECTRICAL MAINTENANCE**
Length	32 to 56 hours.
Purpose	To help the trainee become acquainted with the fundamentals of electricity, the basic types of testing equipment, and practices in electrical maintenance.
Key Content Topics	1. Electrical terminology. 2. Applications of mathematics. 3. Fundamentals of blueprint and electrical diagram reading. 4. Types of electricity. 5. Ohm's Law and power formulae. 6. Types of circuits. 7. Use and maintenance of hand tools and testing equipment. 8. Types of electrical cables; installation and maintenance. 9. Electric motors and electro-mechanical machinery. 10. Electrical safety in both installation and maintenance.
Design	For the person who wants to broaden his ability as a plant mechanic or operator; or wants to move into a job in the electrical specialization, as an Electrician I.
Effective Training Processes	Instructor demonstrations and explanation with a minimum of lecturing. Use job instruction sheets to direct trainees in individualized study and work on small units. Motivate each trainee to search out the additional information needed for solving electrical problems. Instructor outline the electrical experiment; trainees perform the experiment in laboratory or simulated circumstances. Move from the simple to the complex in terms of the trainee's ability and interest. Trainees view film(s); transparencies and slides, both commercial and instructor-made.

Preparation for Jobs in Wastewater Treatment

PLUMBING MAINTENANCE

Module 28	
Length	32 to 56 hours.
Purpose	To help the trainee develop the knowledges and abilities required for him to handle the practical tasks of plumbing work.
Key Content Topics	1. Plumbing supplies, tools, and equipment. 2. Pipe and pipe fittings; measuring, cutting, and threading pipe. 3. Wastewater pumps; characteristics and capacities; pump maintenance. 4. Couplings and valves; stem and hydraulic; valve maintenance. 5. Pipelines, sludge lines, couplings, and valves. 6. Testing for leaks and malfunctions. 7. Safety precautions essential to plumbing.
Design	For plant operators, plant mechanics, and others who want to broaden their knowledges and skills for doing jobs they hold, or to which they hope to advance.
Effective Training Processes	Emphasize explanations and demonstrations over lectures. Use hands-on and simulated exercises in laying out plumbing lines, cutting pipe, threading pipe, and so forth. Instructor demonstration and trainee imitation for use of small tools and supplies. Trainee practice in identification of plumbing supplies and stating of uses of supplies. Directed reading applicable to plumbing wastewater plants. Independent study of plumbing in general to broaden base of the trainee's ability. Trainees study slides and transparencies and pictures from supply house catalogs, etc.

Preparation for Jobs in Wastewater Treatment

Module 29

PAINTING AND OTHER PROTECTIVE MAINTENANCE

Length

32 to 56 hours.

Purposes

To help the trainee gain knowledge of the many and varied factors in the use of protective coatings.

To help the trainee develop basic and specific skills in the application of protective coatings.

Key Content Topics

1. Types of paints and their characteristics.
   a. Composition.
   b. Application conditions.
   c. Properties.
   d. Usages.
2. Color codes and standards; industrial use of color.
3. Surface preparation and pretreatment.
4. Paint application methods.
   a. Hand tools.
   b. Power equipment.
   c. Mixing, matching, and blending.
   d. Ladders, scaffolding, and swing stage equipment.
5. Requisitioning of materials and tools; storing thereof.
6. Standards and quality workmanship in painting.
7. Safety and health considerations.
   a. Hazards from equipment and dust during surface preparation.
   b. Fire and health hazards from solvent vapors.
   c. Safety equipment recommendations.
   d. Air pollution concerns.
   e. Possibility of unique physical and/or mental reactions to paints and thinners.

Design

For the trainee who wants to pursue a career in the specialization of painting. The thrust is toward making the skill most applicable in wastewater plants.

Effective Training Processes

Instructor explanations with illustrative slides, transparencies, paint samples, etc.

Directed and independent reading of selected portions of textbooks and manuals.

Emphasis on demonstrations such as: wielding a brush, applying putty, loading a caulking gun, priming of knots, tinting paint, cleaning a brush, etc.

Divide trainees into work crews for simulated or actual painting practice.

Paint crews critique the work of other crews as well as their own work.

Preparation for Jobs in Wastewater Treatment

AUTOMOTIVE EQUIPMENT MAINTENANCE

Module 30

Length 24 hours.

Purposes To help the trainee learn how to perform the essential and fundamental tasks in the routine care of automotive equipment.

Key Content Topics

1. Introduction to routine maintenance of equipment with which the trainee will work: dump truck, fork lift, tractor.
2. Engine parts: remove, check or service, and replace:
   a. Thermostat.
   b. V-belts.
   c. Air cleaner.
   d. Battery.
   e. Spark plugs.
   f. Other.
3. Check, test, change, or otherwise service.
   a. Oil and oil filter.
   b. Antifreeze solution.
   c. Tires.
   d. Hydraulic fluid.
4. Tools required such as small hand tools, grease guns, etc.
5. Washing, polishing, and other cleaning procedures.
6. Refueling and other general practices.
7. Safety precautions.

Design For the Automotive Equipment Operator who is responsible for care of the equipment he drives. For others, such as the Laborer and Custodian, who may have equipment maintenance as a part of their jobs.

Effective Training Processes

Instructor explanations and demonstrations.
Reading from equipment manuals on maintenance.
Study of pictures, slides, transparencies.
Hands-on introduction to small tools, grease guns, antifreeze testers, hydrometer, etc.
Study of automotive charts for key points in lubrication and other equipment care.
Simulated or actual practice in the recognition of automotive problems or malfunctions.
Analysis of actual procedures followed in keeping maintenance records on such equipment and reporting need for repairs.

Preparation for Jobs in Wastewater Treatment

Module 31

WASTEWATER PLANT OPERATION

Length 24 to 32 hours.

Purposes

To promote development of substantial appreciation of the importance of proper wastewater collection, treatment, and disposal.

To help the trainee learn the proper methods and procedures for operating a wastewater treatment plant.

Key Content Topics

1. Responsibilities of treatment plant operators.
2. Types and characteristics of wastewater.
3. Wastewater collection system.
4. Primary treatment of wastewater.
5. Design and operation of two-story tank units.
6. Fundamentals of sludge digestion.
7. Secondary treatment of wastewater treatment.
8. Uses of chlorine in wastewater treatment.
9. Routine tests of treatment plant efficiency.
10. Special elements of health and safety.

Design

A foundational module of training for wastewater plant operators and maintenance mechanics. Also valuable in various ways for other plant staff.

Effective Training Processes

In-depth lectures.
Class study and independent reading of wastewater treatment manuals, association yearbooks, etc.
Guided discussions and question-and-answer sessions.
Viewing of films with informal follow-up.
Study of slides and transparencies.
Solving of exercises and problems.
Use of tables, graphs, and other data presentations.
Analysis of plant designs and specifications.
Field observations.
Formulation of basic understandings about wastewater treatment.

Preparation for Jobs in Wastewater Treatment

Module 32

Length 24 to 32 hours.

Purposes

To help the trainee with a background in wastewater plant operation to gain additional information that is more advanced and technical.

To help the trainee upgrade his specific skills and functions more effectively in either treatment operations or plant maintenance.

Key Content Topics

1. Physical, chemical, and other characteristics of wastewater.
2. Advanced principles and techniques of primary treatment and sludge digestion.
3. Contact aeration.
4. Biological stabilization ponds.
5. Determination of operating procedures and results.
6. Measurement of wastewater flow.

Design For all plant personnel who have not yet reached the level of understanding of wastewater treatment that is represented by this module. For the worker who knows the "how" of his job, this module will give him much of the "why." Module 31, Wastewater Plant Operation, should be prerequisite.

Effective Training Processes

Study of the manuals that specialize in wastewater treatment.

Instructor presentations with much questioning of trainees over what they have read and experienced in their work.

Analysis of applicable pictures, charts, graphs, etc.

Viewing of films, slides, transparencies in association with instructor pointing up of details.

Instructor-trainee analysis of behavioral objectives in relation to operational procedures.

Use drill exercises to build vocabulary and wastewater terminology.

Preparation for Jobs in Wastewater Treatment

Module 33

WASTEWATER COLLECTION SYSTEMS

Length	24 to 32 hours.
Purposes	To help the trainee with a background in wastewater plant operation better understand the total plan for collection, treatment, and disposal of wastewater.
Key Content Topics	1. How the wastewater collection system works. 2. Materials used in building a wastewater collection system. 3. Construction of wastewater lines. 4. Design and operating features of collection systems. 5. Pumping of wastewater. 6. Collection system operation and maintenance. 7. Special elements of health and safety.
Design	For the plant worker whose perception of his job will be rounded out by understanding of wastewater (sewage) collection. Usually not a required module in the training of plant workers.
Effective Training Processes	Multi-media approach to maintain interest of people not required to know the material presented. Informal discussions with sensitizing patterns. Presentations of local information by wastewater collection supervisor or superintendent. Data gathering to show direction of growth in need for expanded collection system; ways to meet that need. Discretionary reading by trainees. Oral reports on reading done and data gathered. Viewing of film on how sewers are built. Committee group presentation of the history of wastewater collection and treatment.

Preparation for Jobs in Wastewater Treatment

Module 34	**SLUDGE DIGESTION**
Length	24 to 32 class hours plus field trip.
Purposes	To help the trainee gain advanced technical knowledges relative to treating and handling wastewater plant sludge.
Key Content Topics	1. Reasons for sludge digestion. 2. Sludge treatment methods. 3. Types of digestors. 4. Digester controls and test interpretation. 5. Operational checks and sampling schedules. 6. Operational and maintenance problems. 7. Sludge disposal. 8. Gas from sludge digestion. a. Composition and quantity. b. Utilization of sludge gas. c. Hazards and safety measures in sludge gas utilization.
Design	Primarily an in-depth, concentrated, "short course" kind of module to expand the abilities of experienced plant operators and supervisors. Module 32, Wastewater Treatment, should be prerequisite.
Effective Training Processes	Relatively extensive reading by trainees prior to class sessions. In-depth explanations and interpretations by the instructor; correlated with reading by trainees. Pre- and post-tests to point up the extent of acquisition of information by trainees. Structured exchanges of information between trainees, based on their plant experience. Viewing of film(s), slides, pictures, and transparencies. Preview by instructor prior to field trip. Formulation of lists of information to be sought and questions to be answered during field trip; these developed in small group sessions. Field trip to sludge digestion facility. Instructor-directed, follow-up discussion of the field trip experience.

Preparation for Jobs in Wastewater Treatment

Module 35 OPERATION OF AUTOMOTIVE EQUIPMENT

Length 40 hours.

Purposes To help the trainee learn how to operate one or more types of automotive equipment.
To help the trainee understand that safety must be a constant concern with moving vehicles.

Key Content Topics

1. Automotive equipment operation theory.
   a. Engine, gears, instruments.
   b. Differences between gasoline and diesel equipment.
   c. Transmissions; shifting aids; gear trains.
2. Vehicle inspection routines.
   a. Checking oil, fuel, tires, lugs, lights.
   b. Checking warning devices; fire, first aid, and other safety equipment.
   c. Before and after start inspections.
3. Basic vehicle operating techniques.
   a. Starting the engine.
   b. Putting the vehicle in motion.
   c. Steering; use of mirrors.
   d. Use of brakes.
   e. Stopping, backing, parking, and emergency measures.
4. Loading, hauling, dumping.
5. Over-the-road driving.
6. Attitudes required for adherence to vehicle safety rules.

Design For the already hired, or about to be hired, Automotive Equipment Operator. Also, for other wastewater plant workers who operate automotive equipment in their jobs.

Effective Training Processes

Classroom instruction by means of multi-media.
Trainees view films to develop the visual search patterns essential to perceptive driving.
Small-group discussions and interpretations of potential hazards in maneuvering equipment.
Part-task performance of tasks and procedures.
Monitored vehicle operation in simulator or at wheel of the automotive equipment.
Vehicle maneuvering practice at the work site or on the street or highway.
Independent study; instructor-directed meaningful individualization of remedial, review, and enlargement activities in response to evident needs of the trainees.

Preparation for Jobs in Wastewater Treatment

Module 36

ELECTRICAL SYSTEMS

Length

40 to 48 class hours plus observation and/or hands-on practice.

Purposes

To help the trainee understand the principles of electricity and electronics applied in wastewater treatment plants.

To introduce the trainee to electronic control of the treatment processes and electromechanical machinery.

Key Content Topics

1. Behavior of electrons.
2. Electrical circuits.
3. Measuring instruments.
4. Electric motors.
5. Transistors, diodes, triodes, and printed circuits.
6. Solid state electronic devices.
7. Vacuum tubes and their uses.
8. Diagnostic methods in electronic technology.
9. Design of electronic devices in systems.
10. Applications in control of wastewater treatment.

Design

For electricians, operators, maintenance mechanics, and supervisros who need to know the electrical principles basic to the control system used in the wastewater plant.

Effective Training Processes

Step-by-step instruction to guide trainees through study of the technology for which they may have less than adequate backgrounds.

Relate presentations to plant experience of the trainees so they will make daily correlations.

Trainee study and exercise-completion with workbook kinds of text material; programmed textbook-workbook is good.

Use numerous illustrations, particularly from pictures, diagrams, and transparencies.

Develop study-work projects for "buddy" teaching in teams of trainees.

Constantly use summaries, review, and informal testing procedures to insure that trainees keep up with the pace of instruction.

Provide trainee access to essential electronic equipment in a simulated laboratory situation or from time-to-time at a plant, for observation and hands-on experience.

Preparation for Jobs in Wastewater Treatment

Module 37

INSTRUMENTATION

Length 40 class hours plus a plant visitation.

Purposes To help the trainee acquire a foundation in the basic principles of instrument application.

Key Content Topics

1. Principles of instrumentation; measurement and control; man as a systems component.
2. Industrial control theory; final control elements and actuators.
3. Specific processes in control of:
   - a. Pressure.
   - b. Temperature.
   - c. Liquid level.
   - d. Flow.
   - e. Humidity.
   - f. Gravity.
   - g. Viscosity.
   - h. pH factor.
4. Elements in system stability.
   - a. Transducers.
   - b. Recorders and integrators.
   - c. Disturbances in the closed loop.
   - d. Telemetering.
5. Instrumentation drawings.
6. Wastewater treatment plant instrumentation design.
7. Instrument maintenance and repairs.
8. Systems analysis and checking for wastewater treatment process control.

Design For plant operators, maintenance mechanics, electricians, and supervisors in the newer, more sophisticated plants. Module 36, Electrical Systems or the equivalent, is prerequisite.

Effective Training Processes

Study by trainees of material abstracted or adapted from larger sources to provide minimal reading for effective learning.

Instructor presentations to make instrumentation directly applicable to wastewater treatment, clearly and briefly.

Maximize use of overhead projection of graphics.

Discussion presentation by working "expert" from a plant; structured by instructor.

Analysis and interpretation of instrumentation drawings.

Trainee preparation of instrumentation designs and drawings; critiques by other trainees and by the instructor.

Instructor preview followed by group visitation of plant with effective instrumentation system.

Preparation for Jobs in Wastewater Treatment

PRINCIPLES OF PLANT MANAGEMENT

Module 38	
Length	24 to 40 hours.
Purposes	To help the trainee learn how to act effectively and function efficiently as a foreman, supervisor, or superintendent. To help the trainee develop a high level of management-mindedness and leadership skills. To help the trainee learn how to earn his pay as a decision-maker.
Key Content Topics	1. The supervisor's job – past and present. 2. Making the transition from worker to manager. 3. Planning and organizing work. 4. Managing time and delegating your work. 5. Giving directions and orders; supervising employee performance. 6. Motivating, disciplining, handling complaints and grievances of workers. 7. Establishing and maintaining the safety program. 8. Anatomy of a decision.
Design	For those in leadership roles who need to improve their ability to lead, motivate, and supervise subordinates.
Effective Training Processes	Extensive discretionary reading from the many management source materials. Carefully structured lectures by instructor to cover salient points in the minimal time that is available. Pre- and post-testing, with follow-up, to insure understanding of the salient points. Application of self-evaluation techniques in effort to know one's self as a part of understanding and supervising others. Demonstrations of ways to distinguish between the effects of a problem. Analysis of the causes of problems which require management attention. Develop the "management by objectives" approach and techniques. Individual and small-group decision-making with "management action problems."

Preparation for Jobs in Wastewater Treatment

Module 39

PROCUREMENT OF MATERIALS AND EQUIPMENT

Length 24 hours.

Purpose To help the trainee learn how to deal with the formal and detailed procedures for the procurement of materials and equipment.

Key Content Topics

1. Economies resulting from effective requisitioning and purchasing.
2. Evaluation and review of replacement needs.
3. Centralization versus decentralization of the purchasing function.
4. Steps in ordering and receiving materials, supplies, and equipment.
   a. Establishing specifications.
   b. Initiating the ordering and buying procedures.
   c. Investigating and negotiating.
   d. Placing and following up the order.
   e. Receiving and storing.
5. Other aspects of procurement.
   a. Maximizing interchangeability of parts and equipment.
   b. Overcoming delays in purchasing and delivery.
   c. Handling return of unsatisfactory items.
   d. Confusion in trade names, brands, and grades; buying on basis of adaptability.
   e. Special care and attention in stocking such items as grease, oil, paint.

Design For any person in wastewater treatment who can do his job better because he has knowledge of how materials and equipment are acquired and understanding of the interactions between units having responsibility for procurement.

Effective Training Processes

Instructor-trainee study and analysis of the formal and informal procedures for obtaining and stocking materials and equipment.

Explanation of reasons for and uses of the established practices, forms, and channels used in procurement.

Independent and small-group study of the sales manuals of suppliers and manufacturers.

Structured investigation of products and prices for comparison purposes.

Discretionary reading in references dealing with requisitioning, ordering, follow-up, and receiving practices in any industry.

Practice in completing of forms used in the procurement process.

Preparation for Jobs in Wastewater Treatment

Module 40

SUPERVISION OF MAINTENANCE

Length 24 hours.

Purpose To help the trainee learn supervisory "know how" and applications in treatment plant maintenance.

Key Content Topics

1. The supervisor's job.
    a. Selection of a maintenance supervisor.
    b. Specific duties of a supervisor.
2. Scope of the supervisor's responsibilities.
    a. Responsibility for the maintenance crew.
    b. Responsibility for materials, tools, and equipment.
    c. Responsibility for safety and good health.
    d. Interactions with operations staff and the superintendent.
3. Supervising maintenance men at work.
    a. Waht a man expects of his foreman or supervisor.
    b. Maintaining the quality of maintenance work.
    c. Making the maintenance plan and schedule work.
    d. Using budget and cost controls in getting work done effectively.
4. On-the-job training and supervising of work experience in the direction of career growth for subordinates.
5. Evaluation of foremanship and supervision.

Design For seasoned maintenance personnel who are already in supervisory jobs or are being groomed for such responsibility.

Effective Training Processes

Clear and brief presentations by instructor.
Study of brochures, booklets, and manuals relative to supervision.
Discretionary or selected reading from books and other references on supervision in general.
Viewing of film(s) on supervisory techniques.
Follow-up discussion and critique of the film(s)
Exchanges of ideas between trainees with some supervisory experience; or problems of that day.
Simulate conditions or use structure experiences in the recognition of supervisory problems and potential problems.
In small groups, exercise the dynamics of solving certain problems in supervision of maintenance.

Preparation for Jobs in Wastewater Treatment

Module 41

SUPERVISION OF CONTRACTED WORK

Length 16 to 24 hours.

Purpose To help the trainee understand and deal with fundamental concerns and problems in the completion of contract work.

Key Content Topics

1. Adherence to contractual agreements and specifications.
   a. Structure and machine drawings and blueprints.
   b. Detailed descriptions of supplies, materials, and equipment.
   c. Maintaining of deadlines; penalties for time lost.
2. Channels of authority in the doing of contract work.
3. Qualifications of contractors in relation to supervision required.
4. Keeping the plant operative when contracted repair work is in progress.
5. Supervisory aspects of fixed and unit-price contracts.
6. Responsiblity for workmanship and quality of materials used; safety and health.
7. Inspections and approvals.

Design Primarily for the senior maintenance or operations people who want to sharpen and update their supervisory skills in this special area of work.

Effective Training Processes

The emphasis must be on techniques for drawing out information from isolated and often difficult-to-find sources.

Study of *selected* references from among many plant design materials and equipment installation manuals; much adaptation to local needs.

Small-group discussions aimed at particular topics in the area of contract work.

Question-and-answer sessions based on experiences of the senior trainees.

"What I think about supervision of the work I do" – comments by a contractor and responses to questions.

"What I think about the contract work I have supervised" – comments by a plant supervisor or city engineer and responses to questions.

Preparation for Jobs in Wastewater Treatment

Module 42

PLANT REGULATION AND QUALITY STANDARDS

Length 24 hours.

Purposes

To help the trainee who is responsible for wastewater treatment plant supervision and management to comprehend the full scope and nature of the regulations and standards with which he should be concerned.

To help the trainee learn how to deal with the social, economic, and political forces bearing on compliance with regulations and the meeting of quality standards.

Key Content Topics

1. Importance of wastewater treatment controls relating to nuisance elements, diseases, accidents, and so forth.
2. Organization, administration, and enforcement aspects of insuring compliance with regulations and other desirable controls.
3. Wastewater and its relation to public health.
   a. Wastewater irrigation and sludge usage.
   b. Effluent disinfection.
   c. Waste reuse.
4. Natural and non-engineering restraints on wastewater treatment systems.
5. Cost of compliance with regulations and quality standards.

Design

For the wastewater treatment worker who has concern for regulation and quality standards, either as a part of his job or as the result of personal assumption of responsibility for environmental control.

Effective Training Processes

Trainee reading and analysis of printed regulations; federal, state, and local.

Accumulation of data relative to relation of quality standards and extent to which plants meet those standards; this done by small groups.

Limited presentations by instructor.

Reliance upon instructor-directed discussions and question-and-answer sessions.

Structured, multi-media presentation by representative of health department or water quality board.

Preparation for Jobs in Wastewater Treatment

Module 43

EMPLOYMENT AND TRAINING OF STAFF

Length

24 hours.

Purposes

To help the trainee understand the fundamental principles and practices in manpower development and training.

To help the trainee become acquainted with the manpower development and training available in the wastewater field.

To help the trainee develop ability to motivate and direct employees in their acquisition of skills and abilities through training and work experience.

Key Content Topics

1. Principles and practices in manpower planning.
2. Relation of human resource development to water pollution control.
3. Classification and descriptions of wastewater treatment plant jobs.
4. Kinds of training required and existing facilities for such training.
5. Vertical and lateral development in careers in wastewater.
6. Role of the supervisor in the initial employment of people.
7. Role of the supervisor in recommending training outside of the plant.
8. Role of the supervisor in on-the-job training.

Design

An innovative "cram" type module of training in how to create an environment in which subordinates can develop and grow careerwise.

Effective Training Processes

Instructor-directed review of wastewater treatment as a career field.

Selected and discretionary reading relative to hiring, counseling, and training programs and practices.

Simulated role playing in employer-employee interactions aimed at career development.

Sharing of experiences about how good employment and training are achieved.

Small-group consideration of examples of training programs, training facilities, and instructional patterns.

Practice in how to use appraisal reviews to stimulate employee development.

Practice in use of techniques to identify and deal with employee insecurity and withdrawal.

Preparation for Jobs in Wastewater Treatment

Module 44 **PLANT EVALUATION**

Length 24 class hours plus time for simulated or pseudo-evaluation.

Purposes To help the trainee understand the procedures for evaluation of the performance of a plant.
To help the trainee learn how to evaluate unit and process operations for extent of efficiency.

Key Content Topics

1. Plant evaluation procedures.
    a. Preparation for site visit.
    b. On-site inspection.
    c. Techniques of defining and isolating plant problems.
2. Identification and classification of various types of plants.
3. Common problems of operation and maintenance to look for in the inspection.
4. Types of laboratory tests that should be performed.
5. Checking on the operational procedures.
6. Checking on maintenance and corrective measures that are regularly scheduled.
7. Examination of maintenance data and record system.
8. Checking on control and metering system to affirm the plant efficiency record in terms of work economy.

Design For wastewater personnel who need to make plant evaluations, either in assessment of the efficiency of their own plants or in the inspecting of other plants.

Effective Training Processes

In-depth study by trainees of the *Procedural Manual for Evaluating the Performance of Wastewater Treatment Plants* (Reference 7).

Individual and small-group analysis of essential evaluation guides and forms; critique by trainees and instructor.

Instructor presentations and explanations as required to promote full understanding of the procedural pattern and techniques used in plant evaluation.

Simulated practice in evaluation of a pseudo-type evaluation accomplished by visitation of a plant.

Preparation for Jobs in Wastewater Treatment

Module 45 — **WASTEWATER MANAGEMENT RESOURCES**

Length 16 hours.

Purpose To help the trainee learn about the resource materials available to him and how best to use them.

Key Content Topics

1. Work-site management resources.
   a. Structural designs and blueprints of the plant.
   b. Buildings, machinery, and equipment specifications.
   c. Manufacturers' maintenance and operation manuals.
   d. Catalogs of supplies, materials, and equipment.
2. Office and library management resources.
   a. Books published wholly or in part on wastewater treatment.
   b. Magazines of publishing companies, associations, and federations.
   c. Magazine reprints.
   d. Bulletins published by colleges and universities.
   e. Reports of proceedings of associations, conferences, seminars, and short courses.
   f. Manuals of wastewater practices.
   g. Statements of supply and equipment standards.
3. Use of resource materials and facilities at local, state, and regional sites apart from plants and offices.
4. Recourse to consultants and experts in the field.
5. Exchange of management resources with other supervisors and managers.
6. Membership and participation in professional groups.

Design Primarily for the plant superintendent, assistant superintendent, or supervisor who lacks knowledge of where and how to obtain management aid, advice, information, and other professional support.

Effective Training Processes

Instructor presentation of over-view of management resources.
Committee and small-group review and identification of the off-the-shelf kinds of resources available to wastewater plant management.
Analysis and critique of resource materials to promote use of the better items.
Discussion of the why and the wherefor of being professional; ways to participate.

Preparation for Jobs in Wastewater Treatment

Module 46	**WASTEWATER PUBLIC RELATIONS**
Length	16 hours.
Purpose	To help the trainee learn how to present a favorable image of his organization to the public.
Key Content Topics	1. History, scope, ethics, and functions of public relations. 2. Meaning and significance of "social responsibility." 3. Nature and formation of public opinion. 4. Maintaining public interest and active support. 5. Effective public relations tools and media: annual reports, speeches, news and feature stories, letters, public service broadcasts and telecasts, brochures, booklets, school tours. 6. Gaining favorable public opinion and financial support for particular kinds of pollution control and wastewater treatment projects.
Design	Primarily for the superintendent, assistant superintendent, or other personnel having concern or responsibility for public relations.
Effective Training Processes	Instructor should provide exposure to new ideas and techniques. Independent and selected reading books and public relations manuals. Viewing of examples of public relations output on film, TV tapes, slide presentations, transparencies, and so forth. Preparation by individuals or small groups of public relations pieces, oral and written. Preparation and use of employee handbook materials.

Unique Training Needs of the Small Plant

The scope of these guidelines is intended to cover the entire wastewater operational field in a comprehensive manner, from the smallest to the largest plant. To cover such a complex field, wherein each discipline is in itself a technical complicated subject, causes the end result to have the appearance of a grouping of highly specialized vocations.

The most complicated problem has been to "keep it simple" but because of the unique situation occupied by the proliferation of small treatment plants in this country, the guidelines would not be complete without some special discussion devoted to the needs of these installations. The term "small treatment plants" defies a universally accepted definition, but for purposes of this discussion it would be best to narrow this definition down to a few accepted criteria:

1. There is no such plant that does not need an operator.
2. The staff is minimal in number.
3. None of the staff are truly experts in one trade or specialization, but rather they must strive to be "jacks of all trades."
4. The plant in most cases would be provided with something less than 24-hour manned operation.

On the other hand, such a plant should have the following minimum considerations:

a. The person in responsible charge should be a full-time employee.

b. In the past, some communities have assigned the plant responsibilities to a single person, but assigned that person additional duties so that for extended periods of time, the plant is unattended, and required maintenance and operation is neglected.

   Every treatment plant, in addition to the person in responsible charge, should have at least one other employee to assist in the normal routine duties of operation and maintenance. Some of the reasons for this are obvious. There are hazardous duties in and around a plant site, and because accidents happen in even the safest of places, a second employee should be available to aid and assist.

   Many normal duties of maintenance and operation take a minimum of four hands and/or two backs to perform.

c. If a plant is ever left in the care of one man, standard operation procedure includes an hourly reporting or check-in system via radio, telephone, etc.

d. Preventive maintenance should be scheduled during the daytime hours, when full time supervision is available. Operation is predominantly a daytime function except that it should be understood that the presence of operating personnel is directly related to plant flow patterns and problems. If there is no flow at night, then there will be lesser operation problems at night. Conversely, around the clock, twenty-four hour operating personnel might be necessary if conditions warrant.

The foregoing statements help to define "small treatment plants" but much may still be required to accurately describe them.

In general, small plant personnel must be capable of performing routine operation, routine preventative maintenance, maintenance of plant records, and the required laboratory work. In times of emergency or other special circumstances, supplementary work force should be available as needed from other municipal activities or call basis from the private sector.

If it can be assumed that the treatment works has been designed properly, and erected properly, it becomes a basic consideration to protect and prolong the capital investment by instituting proper operation and maintenance. To do this properly, the responsible person has to be a combination laboratory technician, maintenance mechanic, plant operator, and laborer.

To further define the "jack-of-all-trades" kind of plant operator, required to perform the work and fulfill the responsibilities prevailing in the small plant (less than 1 MGD per day), the following job description and qualifications are recommended.

Job Description

Responsible for operation and maintenance of entire plant. Performs any combination of tasks pertinent to controlling operation and maintenance of plant; and supervises and coordinates all plant functions and personnel in accordance with approved policies and procedures. Inspects plant regularly and prepares reports and maintains records. Assists in analyzing and evaluating operation and maintenance functions. Assists in the development of plans and procedures to insure adequate maintenance and efficient plant operation with a wide variety of mechanical and electrical equipment remedial action in emergency situations. Assists in the preparation of budget requests. Performs or assists in routine laboratory tests and analyses.

Basic Qualifications

High school graduate or equivalent. Completion of some vocational training. Good physical condition, mechanical aptitude, facility with mathematics. Holds proper certificate in wastewater treatment, ability to work with others.

Possible adaptations and variations on this definition are, of course, many.

The situation in each plant operation may vary. On one hand, a plant may have a full-fledged electrician available on call, in which case the plant man can be trained in the more simple electrical tasks, leaving the major and/or more detailed work to the journeyman. On the other hand, without an electrician on the staff, or not anyone to "borrow", the plant man may have to become more self-sufficient and self-reliant. Therefore, each of the plant personnel would be well to determine the overall shortcomings of his staff as well as those on an individual basis.

The first source the small plant man looks to for information and help should be the instruction and maintenance manuals provided by the equipment manufacturers along with the equipment installed in the plant. Likewise, a local dealer of oils, greases, and lubricants can provide invaluable information on lubrication maintenance.

All plant personnel should avail themselves of supplementary instruction in courses such as:

Chemistry of Water
Laboratory Procedures
Laboratory Records and Reports
Care and Use of Tools
Mathematics for Operators
Wastewater Plant Operation
Electrical Maintenance
Buildings and Grounds Maintenance
Safety in Operation and Maintenance
Painting and Other Protective Maintenance
Mechanical Maintenance

Availability of such courses may be a problem in some areas. Efforts are being made by agencies, associations, and institutions to extend the offering of courses throughout the country.

It should be reiterated that the preparation of these guidelines were related to the individual rather than the treatment works, and while the issue of individual career development is the prime objective, the training and education of the individual employed at the so-called "small" treatment works more closely parallels the performance of the *works* than that of his counterparts at larger facilities. The percentages prevail. If one employee out of a total work force of three improves his knowledge and proficiency, chances are the treatment works will benefit in equal measure. The disadvantages, of course, are that the "small plant" operator does not come by training or even guidance toward achieving technical competency very easily. Many times this is an infrequent, long-distance effort. The small plant operator must look to his city engineer, his public works director, his consulting engineer, or the state regulatory agency for guidance in what areas to concentrate on career development, for the benefit of his plant as well as his own personal improvement. Likewise, availing himself of formalized training courses may take extra effort because of distance and accessibility. If such training courses can be made available on a regular basis with the support and cooperation of City Officials, such handicaps can be overcome.

Formalized training courses must not only cater to the major population centers but must extend to the sparsely settled areas, to be truly effective. Ways of bringing the training program to the operator must be continually explored. Many communities provide training time for their employees on a matching hour-for-hour basis for lectures or group sessions. Others encourage their employees to obtain formalized training by reimbursing all or part of tuition expenses. The small operation, by its very nature, can little afford to release the personnel for extended periods for training away from home. For some individuals, correspondence school study may be the only available source of training. It would be more successful and fruitful if the school could be brought to the man in addition to sending the man away to the school. Annual attendance at a "short school" is inadequate to attain proficiency.

Relationship of Training to Certification

Wastewater treatment systems are designed to purify, to eliminate nuisances, to reduce interference with recreational activities, and in other ways control the environment. A wastewater treatment plant is designed to prevent water pollution; to maintain a high quality of water.

Each wastewater treatment employee should contribute to achievement of the plant and system goals by effectively performing his duties. Probably nothing has had greater effect in this direction than certification of plant operators.

> The certification of wastewater plant operators in general has increased the operator's pride in his work by giving him a better understanding of his job and what is expected of him. This in turn has made for a better plant operation. (Reference 6)

Certification of wastewater treatment plant operators has become widely accepted throughout the United States as a legitimate state requirement. The operators themselves find the concept and the practice beneficial. And, the belief is building that certification, in order to be most effective, must consider and cover the entire wastewater vocation rather than apply only to the "man in responsible charge".

State regulations, particularly if extended to all plant personnel, will push people into certification programs. Federal support and incentives can accelerate the implementation of widespread training programs to make the training related to certification most effective. It is clear that certification must be in association with good training. This is nowhere more apparent than in the development of the guidelines to career development in this document.

It is generally accepted that good training and certification make a wastewater treatment plant staff more efficient. To illustrate,

Least efficient plant	No continuing training program for staff, certification of operators not required
More efficient plant	Certification required OR continuing training program for itself
MOST efficient plant	Good continuing staff training program AND certification of operators required

In this connection, there should be concern for the vertical mobility of treatment plant workers. A good training and certification program provides for career ladder kinds of growth in employees.

Correlation With Operators' Certification

It was the consensus of the committee responsible for this document that the recommended guidelines to career development should be on a level which might challenge even the best state programs of wastewater treatment plant staffing. It is generally conceded that requirements for certification in wastewater treatment have been entirely too easy to meet. Consequently, the cities have hired whatever type of people they could and, then, tried to make competent operators out of them. This will still continue to be the case, after these guidelines have been widely distributed. But the guidelines may offer a career pattern for the industrious person so that he can aspire and seek preparation to become a wastewater treatment plant superintendent.

The correlation of training modules with operators' certification assumes that eventually a uniform, nationwide certification program will be in effect. A side benefit, then, of this project might be that certain training modules be assimilated in the state certification program.

Generally, the requirements for certification are based upon formal education, specialized training, experience or on-the-job training, and the passing of an examination. Some of the training modules presented in this section can readily be made a part of the specialized training requirement for wastewater plant operators. These are the modules most directly involved with the day-in/day-out operation and maintenance, or the ones most nearly affecting the quality of treatment.

At least fourteen of the 46 training modules are recommended for credits toward certification. They are:

Number	Title
6	Mathematics for Operators & Supervisors
8	Chemistry of Wastewater
9	Treatment Systems
20	Records for Operations & Maintenance
24	Preventive & Corrective Maintenance
25	Machinery Maintenance
31	Wastewater Plant Operation
32	Wastewater Treatment
33	Wastewater Collection Systems
34	Sludge Digestion
36	Electrical Systems
37	Instrumentation
38	Principles of Plant Management
40	Supervision of Maintenance

These 14 training modules, if taught an average of 24 hours each, would constitute a total of 336 class hours. They might be covered in less time or they could be expanded to 400 or more class hours.

The various state certification programs might give credit for these modules of training toward their certifications. In this regard, it is recommended that the Association of Boards of Certification be permitted to assist, review, and even select the courses for which credit is to be given.

Implementation of Training and Certification

The implementation of training and certification of plant operators is now intertwined in most states. It is commonly the responsibility of a single state agency and in most instances the same individual. This results in close coordination of the two activities. Usually the implementation is efficient at relatively low cost.

The close correlation of training and certification sometimes results in problems, such as:

1. Tendency to direct training solely toward answering certification examination questions.
2. Tendency for the pass-fail rate to become a measure of the effectiveness of the training programs.
3. Tendency for certification to be the tool that insures attendance in training classes.

Such problems or conflicts are minimized when training is independent of the certification. But close coordination is necessary to promote proper changes and adjustments in either training or certification.

Several types of training leading to certification are now available to plant operators, but not to all plant personnel. Such training is in the form of correspondence study. Modified correspondence study programs may have one week of concentrated classroom work, then use slide projector and tape recorder presentations for study at home.

Another type of training is the short course. It may range from the two- to four-day study plan to the pattern of several weeks with classes one night or one day each week. The training programs of vocational schools and junior colleges are different, in that they take on the term or semester look. Classes may be held over three months and up to two years. Usually such study programs operate on the base of 40 hours a week. Night classes may be used in connection with on-the-job learning. Such a class might meet four hours a night, once a week, for 11 weeks; a total of 44 hours.

In general, wastewater training programs provide training at beginning or entry level. They usually do not prepare people for the higher levels of certification. A vocational-technical school program over two years of time, obviously, would run the gamut of training for operators.

Section Summary

This section first points up some of the fundamental concerns about training for wastewater treatment plant occupations. The second major part of the section describes the design of the basic module which was used for the building of 46 wastewater training modules or units of subject-matter content. Finally, this section has dealth with the relationship of training and certification. Here there is evidence that the preparation of plant operators is moving along quite well in most states. The training programs fall far short, however, of providing what is needed for the many wastewater workers who are not operators. In total, the 46 training modules in this section constitute the second major set of guidelines to career development for wastewater treatment plant personnel.

SECTION VII

WASTEWATER CAREER DEVELOPMENT

The operating of wastewater treatment plants by means of sophisticated electronic equipment has not eliminated the human being as a factor in good quality operations. Every job is important, whatever its rank may be on the scale of job classification, and it must measure up to certain quality standards. The most elegant wastewater plant in the world, with all its electronic devices, could not operate if it were not for the custodian or the laborer, the man who cleans and maintains the plant at the standard required for safe and efficient operation.

The need for trained wastewater plant workers will continue beyond the current high rate of demand. The challenge is to match people and jobs in meaningful wastewater career development programs.

It is the intent of this relatively brief section to help you define the kinds of employment and training that will best serve the needs of your particular community. It is also the intent to help you guide and direct those who want to pursue careers in wastewater treatment under your general supervision. The material here, then, deals with the jobs in wastewater treatment, the modules of training that fit those jobs, and the planning required to bring the two aspects together.

The Jobs

In Section III, occupational summaries are presented for 21 jobs in wastewater treatment plants. The summaries contain descriptions of jobs, basic qualifications, training and sources of training, along with entry and advancement information. It is from the occupational summaries foundation that guidelines for training were developed.

Some of the 21 jobs, such as Custodian and Maintenance Helper, can be mastered by entry employees of limited ability in a relatively short time. Other jobs, such as Laboratory Technician and Assistant Superintendent, typically require training at the post-secondary level. Each of the jobs is identified with the *Dictionary of Occupational Titles* in terms of a specific job classification and a DOT number.

Before proceeding with the remainder of this section, you may want to turn back to Section III to review the employment aspect of the guidelines to career development in wastewater treatment.

The Training Modules

In Section IV, modules of training are presented for 46 unit categories of subject-matter content. The modular presentations contain information relative to length, purpose, content topics, design, and training processes applicable to each module. The 46 modules of training are indicated on the following page in terms of categories of difficulty or complexity. The identification of categories is individual-oriented in terms of needs such as basic or specialized. Again, if review is needed, will you please turn back to Section IV.

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Training Modules for Wastewater Treatment Plant Occupations

(Organized in patterns of difficulty or complexity.)

Basic Modules

1.	O	Orientation
2.	CS	Communication Skills
3.	PJB	Personal & Job Behavior
4.	GED	General Educational Development
5.	BRM	Basic & Related Mathematics
7.	BRS	Basic & Related Science
13.	FA	First Aid & Accident Prevention
22.	CUT	Care & Use of Tools
31.	WPO	Wastewater Plant Operation

Intermediate Modules

6.	MOS	Mathematics for Operators & Supervisors
8.	CW	Chemistry of Wastewater
14.	SOM	Safety in Operation & Maintenance
19.	RIC	Recordkeeping & Inventory Control
20.	ROM	Records for Operations & Maintenance
23.	BGM	Buildings & Grounds Maintenance
24.	PCM	Preventive & Corrective Maintenance
32.	WT	Wastewater Treatment
33.	WCS	Wastewater Collection Systems

Advanced Modules

9.	TS	Treatment Systems
10.	LRR	Laboratory Records & Reports
15.	SP	Safety Program
21.	FR	Financial Reports
25.	MM	Mechanical Maintenance
34.	SD	Slude Digestion
38.	PPM	Principles of Plant Management
39.	PME	Procurement of Materials & Equipment
40.	SM	Supervision of Maintenance
41.	SCW	Supervision of Contracted Work
42.	PRS	Plant Regulation & Quality Standards
43.	ETS	Employment & Training of Staff
44.	PE	Plant Evaluation
45.	WMR	Wastewater Management Resources
46.	WPR	Wastewater Public Relations

Specialized Modules

11.	LP	Laboratory Procedures
12.	LR	Laboratory Research
16.	CP	Clerical Practices
17.	TA	Typewriting Applications
18.	RM	Records Management
26.	GAW	Gas & Arc Welding
27.	EM	Electrical Maintenance
28.	PM	Plumbing Maintenance
29.	POM	Painting & Other Protective Maintenance
30.	AEM	Automotive Equipment Maintenance
35.	OEA	Operation of Automotive Equipment
36.	ES	Electrical Systems
37.	I	Instrumentation

The Training Plan

The planning of any activity usually requires the use of certain instruments or materials. Even a short trip by auto may require the use of a map. In this instance, we recommend the use of a planning grid.

The *Career Development Planning Grid* presented here as a fold-out is for use with wastewater treatment plant personnel. It contains categories of information as follows:

1. Functional areas of employment with breakdowns of:
   a. Job Title.
   b. DOT Number.
2. Listing of 46 training modules in more-or-less academic segments and including:
   a. Number of the module.
   b. Letter symbol code for each module.
   c. Full title for each module.
3. Columnar grid planning space including:
   a. Academic segment headings.
   b. Number and letter code for 46 modules.
   c. Panels into which letters "E" or "D" may be inserted to indicate modules of training that are *Essential* and those that are *Desireable.*
4. Explanation of how to use the grid.
   a. *Essential* and *Desirable* designations of what to study for each job classification.
   b. Blank panel representing modules already studied or for a more advanced job.
5. Indication of the 14 modules of training that are quite directly related to the certification of Plant Operators.

It is hoped that with this brief explanation, the review of the more lengthy preceeding sections, you will be able to make good and extensive use of the planning grid. With this systematized approach to employment and training your job should become easy and the results more productive. Your personnel should perform their jobs more effectively and your wastewater treatment plant should show a higher operational efficiency rating.

SECTION VII

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